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NEW CHAPTERS IN THE WARFARE OF SCIENCE.

XX.—FROM THE DIVINE ORACLES TO THE HIGHER CRITICISM.

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IV. THE CLOSING STRUGGLE.

THE storm aroused by Essays and Reviews had not yet subsided when a far more serious tempest burst upon the English theological world.

In 1862 appeared a work entitled The Pentateuch and the Book of Joshua Critically Examined, its author being Colenso, Anglican Bishop of Natal in South Africa. He had formerly been highly esteemed as fellow and tutor at Cambridge, master at Harrow, and author of various valuable text-books in mathematics. Had he exercised his powers within the limits of popular orthodoxy, he was evidently in the way to the highest positions in the Church; but he chose another path. His treatment of his subject was reverent, but he had gradually come to those conclusions, then so daring, now so widespread among Christian scholars, that the Pentateuch, with much valuable historical matter, contains much that is unhistorical; that a large portion of it was the work of a comparatively late period in Jewish history; that many passages in Deuteronomy could only have been written after the Jews settled in Canaan; that the Mosaic law was not in force before the captivity; that the book of Chronicles was clearly written as an afterthought to enforce the views of the priestly caste; and that in all the books there is much that is mythical and legendary.

These statements, which now seem so moderate, then aroused

horror. Especial wrath was caused by some of his arithmetical arguments, and, among them, those which showed that an army of six hundred thousand men could not have been mobilized in a single night; that three millions of people, with their flocks and herds, could neither have obtained food on so small and arid a desert as that over which they were said to have wandered during forty years, nor water from a single well; and that the butchery of two hundred thousand Midianites by twelve thousand Israelites, "exceeding infinitely in atrocity the tragedy at Cawnpore, had happily only been carried out on paper." There was nothing of the scoffer in him. While preserving his own independence, he had kept in touch with the most earnest thought both among European scholars and in the little flock intrusted to his care. He evidently remembered what had resulted from the attempt to hold the working classes in the towns of France, Germany, and Italy to outworn beliefs; he had found even the Zulus, whom he had thought to convert, awakened to the legendary character of the Old Testament, and with his clear, practical mind he realized the danger which threatened the English Church and Christianity—the danger of tying its religion and morality to interpretations and conceptions of Scripture more and more widely seen and felt to be contrary to facts. He saw the especial danger of sham explanations; of covering up facts which must soon be known, and which, when all was revealed, must inevitably bring the plain people of England to regard their teachers, even the most deserving, as "solemnly constituted impostors"; ecclesiastics whose tenure depends on assertions which they know to be untrue. Therefore it was that, when his catechumens questioned him regarding some of the legends in the Old Testament, the bishop determined to tell the truth. He says: "My heart answered in the words of the prophet, 'Shall a man speak lies in the name of the Lord?' I determined not to do so."

But none of these considerations availed in his behalf at first. The outcry against the work was deafening; churchmen and dissenters rushed forward to attack it. Archdeacon Denison, chairman of the Committee of Convocation appointed to examine it, uttered a noisy anathema. Convocation solemnly condemned it; and a zealous colonial bishop, relying upon a nominal supremacy, deposed and excommunicated its author, declaring him "given over to Satan." On both sides of the Atlantic the press groaned with "answers," some of these being especially injurious to the cause they were intended to serve, and none more so than sundry efforts by the bishops themselves. One of the points upon which they attacked him was his assertion that the reference in Leviticus to the hare chewing its cud contains an error. Upon this Prof. Hitzig of Leipsic, probably the best Hebrew scholar of his time,

remarked: "Your bishops are making themselves the laughing-stock of Europe. Every Hebraist knows that the animal mentioned in Leviticus is really the hare; . . . every zoölogist knows that it does not chew the cud."*

On Colenso's return to Natal, where many of the clergy and laity who felt grateful for his years of devotion to them received him with signs of affection, an attempt was made to ruin these clergymen by depriving them of their little stipends, and to terrify the simple-minded laity by threatening them with the same "greater excommunication" which had been inflicted upon their bishop. To make the meaning of this more evident, the vicar-general of the Bishop of Cape Town met Colenso at the door of his own cathedral, and solemnly bade him "depart from the house of God as one who has been handed over to the Evil One." The sentence of excommunication was read before the assembled faithful, and they were enjoined to treat their bishop as "a heathen man and a publican." But these and a long series of other persecutions created a reaction in his favor.

There remained to Colenso one bulwark which his enemies found stronger than they had imagined—the British courts of justice. The greatest efforts were now made to gain the day before these courts, to humiliate Colenso, and to reduce to beggary the clergy who remained faithful to him, and it is worthy of note that one of the leaders in preparing the legal plea of the committee against the accused was Mr. Gladstone.

But this bulwark proved impregnable; both the Judicial Committee of the Privy Council and the Rolls Court decided in Colenso's favor. Not only were his enemies thus forbidden to deprive him of his salary, but their excommunication of him was made null and void; it became, indeed, a subject of ridicule, and even a man so enwrapped in religious thought as John Keble confessed and lamented that the English people no longer believed in excommunication. The bitterness of the defeated found vent in the utterances of the colonial metropolitan who had excommunicated Colenso—Bishop Gray, "the Lion of Cape Town"—who denounced the judgment as "awful and profane" and the Privy Council as "a masterpiece of Satan" and "the great dragon of the English Church." Even Wilberforce, careful as

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* For the passages referred to as provoking especial wrath, see Colenso, Lectures on the Pentateuch and the Moabite Stone, 1876, p. 217. For the episode regarding the hare chewing the cud, see Cox, Life of Colenso, i, p. 240. The following epigram went the rounds:

"The bishops all have sworn to shed their blood
To prove 'tis true the hare doth chew the cud.
O bishops, doctors, and divines, beware—
Weak is the faith that hangs upon a *hair!*"

he was to avoid attacking anything established, alluded with deep regret to "the devotion of the English people to the law in matters of this sort."

Their failure in the courts only seemed to increase the violence of the attacking party. The Anglican communion, both in England and America, was stirred to the depths against the heretic, and various dissenting bodies strove to show equal zeal. Great pains were taken to root out his reputation; it was declared that he had merely stolen the ideas of rationalists on the Continent by wholesale, and then peddled them out in England at retail; the fact being that, while he used all the sources of information at his command, and was large-minded enough to put himself into relations with the best biblical scholarship of the Continent, he was singularly independent in his judgment, and his own investigations were of lasting value in modifying Continental thought. Kuenen, the most distinguished of all his contemporaries in this field, modified, as he himself declared, one of his own leading theories after reading Colenso's argument; and other Continental scholars scarcely less eminent acknowledged their great indebtedness to the English scholar for original suggestions.*

But the zeal of the bishop's enemies did not end with calumny. He was socially ostracized; more completely even than Lyell had been after the publication of his Principles of Geology thirty years before. Even old friends left him, among them Frederick Denison Maurice, who, when himself under the ban of heresy, had been defended by Colenso. Nor was Maurice the only heretic who turned against him; Matthew Arnold attacked him, and set up, as a true ideal of the work needed to improve the English Church and people, of all books in the world, Spinoza's Tractatus! A large part of the English populace was led to regard him as an "infidel," a "traitor," an "apostate," and even as "an unclean being"; servants left his house in horror; "Tray, Blanche, and Sweetheart were let loose upon him"; and one of the favorite

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* For interesting details of the Colenso persecution, see Davidson's Life of Tait, chaps. xiii and xiv; also the Lives of Bishops Wilberforce and Gray. For full accounts of the struggle, see Cox, Life of Bishop Colenso, London, 1888, especially vol. i, chap. v. For the dramatic performance at Colenso's cathedral, see vol. ii, pp. 14–25. For a very impartial and appreciative statement regarding Colenso's work, see Cheyne, Founders of Old Testament Criticism, London, 1893, chap. ix. For testimony to the originality and value of Colenso's contributions, see Kuenen, Origin and Composition of the Hexateuch, introduction, p. xx, as follows: "Colenso directed my attention to difficulties which I had hitherto failed to observe or adequately to reckon with, and, as to the opinion of his labors current in Germany, I need only say that, inasmuch as Ewald, Bunsen, Bleek, and Knabel were every one of them logically forced to revise their theories in the light of the English bishop's researches, there was small reason in the cry that his methods were antiquated and his objections stale."

amusements of the period among men of petty wit and no convictions was the devising of light ribaldry against him.*

In the midst of all this controversy stood three men, each of whom has connected his name with it permanently.

First of these was Samuel Wilberforce, at that time Bishop of Oxford. The gifted son of William Wilberforce, who had been honored throughout the world for his efforts in the suppression of the slave trade, he had been rapidly advanced in the English Church, and was at this time a prelate of wide influence. He was eloquent and diplomatic, witty and amiable, always sure to be with his fellow-churchmen and polite society against uncomfortable changes. Whether the struggle was against the slave power in the United States, or the squirearchy in Great Britain, or the evolution theory of Darwin, or the new views promulgated by the Essayists and Reviewers, he was always the suave spokesman of those who opposed every innovator and "besought him to depart out of their coasts." Mingling in curious proportions a truly religious feeling with care for his own advancement, his remarkable power in the pulpit gave him great strength to carry out his purposes, and his charming facility in being all things to all men, as well as his skill in evading the consequences of his many mistakes, gained him the sobriquet of "Soapy Sam." If such brethren of his in the episcopate as Thirlwall and Selwyn and Tait might claim to be in the apostolic succession, Wilberforce was no less surely in the succession from the most gifted and eminently respectable Sadducees who held high preferment under Pontius Pilate.

By a curious coincidence he had only a few years before preached the sermon when Colenso was consecrated in Westminster Abbey, and one passage in it may be cited as showing the preacher's gift of prophecy both hortatory and predictive. Wil-

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* One of the nonsense verses in vogue at the time summed up the controversy as follows:

"A bishop there was of Natal,
Who had a Zulu for his pal;
Said the Zulu, 'My dear,
Don't you think Genesis queer?'
Which converted my lord of Natal."

But verses quite as good appeared on the other side, one of them being as follows:

"Is this, then, the great Colenso,
Who all the bishops offends so?
Said Sam of the Soap,
'Bring fagots and rope,
For oh! he's got no friends, oh!'"

For Matthew Arnold's attack on Colenso, see Macmillan's Magazine, January, 1863. For Maurice, see the references already given.

berforce then said to Colenso: "You need boldness to risk all for God; to stand by the truth and its supporters against men's threatenings and the devil's wrath; . . . you need a patient meekness to bear the galling calumnies and false surmises with which, if you are faithful, that same Satanic working which, if it could, would burn your body, will assuredly assail you daily through the pens and tongues of deceivers and deceived, who, under a semblance of a zeal for Christ, will evermore distort your words, misrepresent your motives, rejoice in your failings, exaggerate your errors, and seek by every poisoned breath of slander to destroy your powers of service." *

Unfortunately, when Colenso followed this advice, his adviser became the most untiring of his persecutors. While leaving to men like the Metropolitan of Cape Town and Archdeacon Denison the noisy part of the onslaught, Wilberforce was among those who were most zealous in devising more effective measures.

But time, and even short time, has redressed the balance between the two prelates. Colenso is seen more and more of all men as a righteous leader in a noble effort to cut the Church loose from fatal entanglements with an outworn system of interpretation; Wilberforce, as the remembrance of his eloquence and of his personal charms dies away, and as the revelations of his indiscreet biographers lay bare his modes of procedure, is seen to have left, on the whole, the most disppointing record made by any Anglican prelate during the nineteenth century.

But there was a far brighter page in the history of the Church of England; for the second of the three who linked their names with that of Colenso in the struggle was Arthur Penrhyn Stanley, Dean of Westminster. His action during this whole persecution was an honor not only to the Anglican Church but to humanity. For his own manhood and the exercise of his own intellectual freedom he had cheerfully given up the high preferment in the Church which had been easily within his grasp. To him truth and justice were more than the decrees of a Convocation of Canterbury or of a Pan-Anglican Synod; in this as in other matters he braved the storm, never yielded to theological prejudice, from first to last held out a brotherly hand to the persecuted bishop,

* For the social ostracism of Colenso, see works already cited; also Cox's Life of Colenso. For the passage from Wilberforce's sermon at the consecration of Colenso, see Rev. Sir G. W. Cox, The Church of England and the Teaching of Bishop Colenso. For Wilberforce's relations to the Colenso case in general, see his Life, by his son, vol. iii, especially pp. 113–126 and 229–231. For Keble's avowal that no Englishman believes in excommunication, ibid., p. 128. For a guarded statement of Dean Stanley's opinion regarding Wilberforce and Newman, see a letter from Dean Church to the Warden of Keble, in Life and Letters of Dean Church, p. 293.

and at the most critical moment opened to him the pulpit of Westminster Abbey.*

The third of the high ecclesiastics of the Church of England whose names were linked in this contest was Thirlwall.

He was undoubtedly the foremost man in the Church of his time—the greatest ecclesiastical statesman, the profoundest historical scholar, the theologian of clearest vision in regard to the relations between the Church and his epoch. Alone among his brother bishops at this period, he stood "four square to all the winds that blew," as during all his life he stood against all storms of clerical or popular unreason. He had his reward. He was never advanced beyond a poor Welsh bishopric; but, though he saw men wretchedly inferior constantly promoted beyond him, he never flinched, never lost heart or hope, but bore steadily on, refusing to hold a brief for lucrative injustice, and resisting to the last all reaction and fanaticism, thus preserving not only his own self-respect but the future respect of the English nation for the Church.

A few other leading churchmen were discreetly kind to Colenso, among them Tait, who had now been made Archbishop of Canterbury; but, manly as he was, he was somewhat more cautious in this matter than those who most revere his memory could now wish.

In spite of these friends the clerical onslaught was for a time effective; Colenso, so far as England was concerned, was discredited and virtually driven from his functions. But this enforced leisure simply gave him more time to struggle for the protection of his native flock against colonial rapacity, and to continue his great work on the Bible.

His work produced its effect. The impulse which it gave had much to do with arousing a new generation of English, Scotch, and American scholars. That a new epoch had come was now more and more evident, and out of the many proofs of this we may note two of the most striking.

For many years the Bampton Lectures at Oxford had been considered as adding steadily and strongly to the bulwarks of the old orthodoxy. If now and then orthodoxy had appeared in

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* For interesting testimony to Stanley's character, from a quarter whence it would have been least expected, see a reminiscence of Lord Shaftesbury in the Life of Frances Power Cobbe, London and New York, 1894. The late Bishop of Massachusetts, Phillips Brooks, whose death was a bereavement to his country and to the Church universal, once gave the present writer a vivid description of a scene witnessed by him in the Convocation of Canterbury, when Stanley virtually withstood alone the obstinate traditionalism of the whole body in the matter of the Athanasian Creed. It is to be hoped that this account may be brought to light among the letters written by Brooks at that time. See also Dean Church's Life and Letters, p. 294, for a very important testimony.

danger from such additions to the series as those made by Dr. Hampden, these lectures had been, as a rule, saturated with the older traditions of the Anglican Church. But now there came an evident change. The departures from the old paths became many and striking, until at last, in 1893, came the lectures on Inspiration by the Rev. Dr. Sanday, Ireland Professor of Exegesis in the University of Oxford. In these, concessions were made to the newer criticism, which at an earlier time would have driven the lecturer not only out of the Church but out of any decent position in society; for Prof. Sanday not merely gave up a vast mass of the other ideas which the great body of churchmen had regarded as fundamental, but accepted a number of conclusions established by the newer criticism. He declared that Kuenen and Wellhausen had mapped out, on the whole rightly, the main stages of development in the history of Hebrew literature; he incorporated with approval the work of other eminent heretics; he acknowledged that very many statements in the Pentateuch show "the naïve ideas and usages of a primitive age." But, most important of all, he gave up the whole question in regard to the book of Daniel. Up to a time then very recent, the early authorship and predictive character of the book of Daniel were things which no one was allowed to dispute for a moment. Pusey, as we have seen, had proved to the controlling parties in the English Church that Christianity must stand or fall with the traditional view of this book; and now, within a few years of Pusey's death, there came in his own university, speaking from the pulpit of St. Mary's, whence he had so often insisted upon the absolute necessity of maintaining the older view, this professor of biblical criticism, a doctor of divinity, showing conclusively as regards the book of Daniel that the critical view had won the day; that the name of Daniel is only assumed; that the book is in no sense predictive, but was written, mainly at least, after the events it describes; that "its author lived at the time of the Maccabean struggle"; that it is very inaccurate even in the simple facts which it cites; and hence that all the vast fabric erected upon its predictive character is baseless.

But another evidence of the coming in of a new epoch was even more striking.

To uproot every growth of the newer thought, to destroy even every germ that had been planted by Colenso and men like him, a special movement was begun, of which the most important part was the establishment at the University of Oxford of a college which should bring the old opinion with crushing force against the new thought, and should train up a body of young men by feeding them upon the utterances of the fathers, of the mediæval doctors, and of the apologists of the seventeenth and eighteenth

centuries, and should keep them in happy ignorance of the reforming spirit of the sixteenth and the scientific spirit of the nineteenth century.

The new college thus founded bore the name of the poet most widely beloved among high churchmen; large endowments flowed in upon it; a showy chapel was erected in accordance throughout with the strictest rules of mediæval ecclesiology. As if to strike the keynote of the thought to be fostered in the new institution, one of the most beautiful of pseudo-mediæval pictures was given the place of honor in its hall, and the college, lofty and gaudy, loomed high above the neighboring modest abode of Oxford science. Kuenen might rage in Holland, and Wellhausen in Germany, and Robertson Smith in Scotland—even Professors Driver, Sanday, and Cheyne might succeed Dr. Pusey as expounders of the Old Testament at Oxford—but Keble College, rejoicing in the favor of a multitude of leaders in the Church, including Mr. Gladstone, seemed an inexpugnable fortress of the older thought.

But in 1889 appeared the book of essays entitled Lux Mundi, among whose leading authors were men closely connected with Keble College and with the movement which had created it. This work gave up entirely the tradition that the narrative in Genesis is a historical record, and admitted that all accounts in the Hebrew Scriptures of events before the time of Abraham are mythical and legendary; it conceded that the books ascribed to Moses and Joshua were made up mainly of three documents representing different periods, and one of them the late period of the exile; that "there is a considerable idealizing element in Old Testament history"; that "the books of Chronicles show an idealizing of history" and "a reading back into past records of a ritual development which is really later," and that prophecy is not necessarily predictive—"prophetic inspiration being consistent with erroneous anticipations." Again a shudder went through the upholders of tradition in the Church, and here and there threats were heard; but the Essays and Reviews *fiasco* and the Colenso catastrophe were still in vivid remembrance. Good sense prevailed, and Benson, Archbishop of Canterbury, instead of prosecuting the authors, himself asked the famous question, "May not the Holy Spirit make use of myth and legend?" *

In the sister university the same tendency was seen. Robertson Smith, who had been driven out of his high position in the

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* Of Pusey's extreme devotion to his view of the book of Daniel there is a curious evidence in a letter to Stanley in the second volume of the latter's Life and Letters. For the views referred to in Lux Mundi, see pages 345–357; also, on the general subject, Bishop Ellicott's Christus Comprobator.

Free Church of Scotland on account of his work in scriptural research, was welcomed into a professorship at Cambridge, and other men, no less loyal to the new truths, were given places of controlling influence in shaping the thought of the new generation.

Nor did the warfare against biblical science produce any different results among the dissenters of England. In 1862 Samuel Davidson, a professor in the Congregational College at Manchester, published his Introduction to the Old Testament. Independently of the contemporary writers of Essays and Reviews, he had arrived in a general way at conclusions much like theirs, and he presented the newer view with fearless honesty, admitting that the same research must be applied to these as to other Oriental sacred books, and that such research establishes the fact that all alike contain legendary and mythical elements. A storm was at once aroused; certain denominational papers took up the matter, and Davidson was driven from his professorial chair; but he labored bravely on, and others followed to take up his work, until the ideas which he had advocated were fully considered.

So, too, in Scotland the work of Robertson Smith was continued even after he had been driven into England, and, as votaries of the older thought passed away, men of ideas akin to his were gradually elected into chairs of biblical criticism and interpretation. Wellhausen's great work, which Smith had introduced in English form, proved a power both in England and Scotland, and the articles upon various books of Scripture and scriptural subjects generally, in the ninth edition of the Encyclopædia Britannica, having been prepared mainly by himself as editor or put into the hands of others representing the recent critical research, this very important work of reference, which had been in previous editions so timid, was now arrayed on the side of the newer thought, insuring its due consideration wherever the English language is spoken.

In France the same tendency was seen, though with striking variations from the course of events in other countries—variations due to the very different conditions under which biblical students in France were obliged to work. Down to the middle of the nineteenth century the orthodoxy of Bossuet, stiffly opposing the letter of Scripture to every step in the advance of science, had only yielded in a very slight degree. But then came an event ushering in a new epoch. At that time Jules Simon, afterward so eminent as an author, academician, and statesman, was quietly discharging the duties of a professorship, when there was brought to him one day the visiting card of a stranger bearing the name of "Ernest Renan, Student at St. Sulpice." Admitted to M. Simon's library, Renan told his story. As a theological student, even

before he entered the seminary, he had devoted himself most earnestly to the study of Hebrew and the Semitic languages, and he was now obliged, during the lectures on biblical literature at St. Sulpice, to hear the reverend professor make frequent comments upon the Scriptures, based on the Vulgate, but absolutely disproved by Renan's own knowledge of Hebrew. On Renan's questioning any interpretation of the lecturer, the latter was wont to rejoin: "Monsieur, do you presume to deny the authority of the Vulgate, the translation by St. Jerome, sanctioned by the Holy Ghost and the Church? You will at once go into the chapel and say 'Hail Mary' for an hour before the image of the Blessed Virgin." "But," said Renan to Jules Simon, "this has now become very serious; it happens nearly every day, and, *mon Dieu!* monsieur, I can not spend *all* my time in saying 'Hail Mary' before the statue of the Virgin." The result was a warm personal attachment between Simon and Renan; both were Bretons, educated in the midst of the most orthodox influences, and both had unwillingly broken away from them.

Renan was now emancipated and pursued his studies with such effect that he was made professor at the Collége de France. His Life of Jesus, and other books showing the same spirit, brought a tempest upon him which drove him from his professorship and brought great hardships upon him for many years. But his genius carried the day, and, to the honor of the French Republic, he was restored to the position from which the Empire had driven him. From his pen finally appeared the Histoire du Peuple Israel, in which scholarship broad, though at times inaccurate in minor details, was supplemented by an exquisite acuteness and a poetic insight which far more than made good any of those lesser errors which a German student would have avoided. At his death, in October, 1892, this monumental work had been finished; in clearness and beauty of style it has never been approached by any other treatise on this or any kindred subject. It is a work of genius, and its profound insight into all that is of importance in the great subjects which he treated will doubtless cause it to hold a permanent place in the literature not only of the Latin nations but of the world.

The anathemas lavished upon him by Church authorities during his life, their denial to him of Christian burial, and their refusal to allow him a grave in the place he had chosen, only increased popular affection for him during his last years and deepened the general mourning at his death.*

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* The facts as to the early relations between Renan and Jules Simon were told in 1878 by the latter to the present writer at considerable length and with many interesting details not here given. The writer was also present at the public funeral of the great scholar, and can

But, in spite of all resistance, the desire for more light upon the sacred books penetrated the older Church from every side.

In Germany, toward the close of the eighteenth century, Jahn, Catholic professor at Vienna, had ventured, in an Introduction to Old Testament Study, to class Job, Jonah, and Tobit below other canonical books, and had only escaped serious difficulties by ample amends in a second edition.

Early in the nineteenth century, Herbst, Catholic professor at Tübingen, had endeavored in a similar Introduction to bring more modern research to bear on the older view; but the Church authorities saw that all passages really giving any new light were skillfully and speedily edited out of the book.

Later still, Movers, professor at Breslau, showed remarkable gifts for Old Testament research, and much was expected of him; but his ecclesiastical superiors quietly prevented his publishing any extended work.

During the latter half of the nineteenth century much the same pressure has continued in Catholic Germany. Strong scholars have very generally been drawn into the position of "apologists," and, when this has been found impossible, they have been driven out of the Church.

The same general policy had been evident in France and Italy, but toward the last decade of the century it was seen by the more clear-sighted supporters of the older Church in those countries that the multifarious "refutations" and explosive attacks upon Renan and his teachings had accomplished nothing; that even special services of atonement for his sin, like the famous "*Triduo*" at Florence, only drew a few women and provoked ridicule among the public at large; that throwing him out of his professorship and calumniating him had but increased his influence; and that his brilliant intuitions, added to the careful researches of German and English scholars, had brought the thinking world beyond the reach of the old methods of hiding troublesome truths and crushing persistent truth-tellers.

Therefore it was that about 1890 a body of earnest Roman Catholic scholars began very cautiously to examine and explain the biblical text in the light of those results of the newer research which could no longer be gainsaid.

Among these men were, in Italy, Canon Bartolo, Canon Berta,

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testify of his own knowledge to the deep and hearty evidences of gratitude and respect then paid to Renan, not merely by eminent orators and scholars, but by the people at large. As to the refusal of the place of burial which Renan especially chose, see his own "Souvenirs," in which he laments the inevitable exclusion of his grave from the site which he most loved. As to calumnies, one masterpiece very widely spread, through the zeal of clerical journals, was that Renan received enormous sums from the Rothschilds for attacking Christianity.

and Father Savi, and in France Monseigneur d'Hulst, the Abbé Loisy, Professor at the Roman Catholic University at Paris, and, most eminent of all, Professor Lenormant, of the French Institute, whose researches into biblical and other ancient history and literature had won him distinction throughout the world. These men, while standing up manfully for the Church, were obliged to allow that some of the conclusions of modern biblical criticism were well founded. The result came rapidly. The treatise of Bartolo and the great work of Lenormant were placed on the Index; Canon Berta was overwhelmed with reproaches and virtually silenced; the Abbé Loisy was first deprived of his professorship, and then ignominiously expelled from the university; Monseigneur d'Hulst was summoned to Rome, and has since kept silence.*

The matter was evidently thought serious in the higher regions of the Church, for, in November, 1893, appeared an encyclical letter on The Study of Sacred Scripture by the reigning Pope, Leo XIII. Much was expected from it, for, since Benedict XIV in the last century, there has sat on the papal throne no Pope intellectually so competent to discuss the whole subject. While, then, those devoted to the older beliefs trusted that the papal thunderbolts would crush the whole brood of biblical critics, votaries of the newer thought ventured to hope that the encyclical might, in the language of one of them, prove "a stupendous bridge spanning the broad abyss that now divides alleged orthodoxy from established science." †

Both these expectations were disappointed; and yet, on the whole, it is a question whether the world at large may not congratulate itself upon this papal utterance. The document, if not apostolic, won credit as "statesmanlike." It took pains, of course, to insist that there can be no error of any sort in the sacred books; it even defended those parts which Protestants count apocryphal as thoroughly as the remainder of Scripture, and declared that the book of Tobit was not compiled of man, but written by God. His Holiness naturally condemned the higher criticism, but he dwelt at the same time on the necessity of the most thorough study of the sacred Scriptures, and especially on the importance

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* For the frustration of attempts to admit light into scriptural studies in Roman Catholic Germany, see Bleek, Old Testament, London, 1882, vol. i, pp. 19, 20.

For the general statement regarding recent suppression of modern biblical study in France and Italy, see an article by a Roman Catholic author in the Contemporary Review, September, 1894, p. 365. For the papal condemnations of Lenormant and Bartolo, see the Index Librorum Prohibitorum Sanctissimi Domini Nostri Leonis XIII, P. M., etc., Rome, 1891; Appendices, July, 1890, and May, 1891. The ghastly part of the record, as stated in this edition of the Index, is that both these great scholars were forced to abjure their "errors" and to acquiesce in the condemnation—Lenormant doing this on his deathbed.

† For this statement, see an article in the Contemporary Review, April, 1894, p. 576.

of adjusting scriptural statements to scientific facts. This utterance was admirably oracular, being susceptible of cogent quotation by both sides; nothing could be in better form from an orthodox point of view; but, with that statesmanlike forecast which the present Pope has shown more than once in steering the bark of St. Peter over the troubled waves of the nineteenth century, he so far abstained from condemning any of the greater specific results of modern critical study that the main English defender of the encyclical, the Jesuit Father Clarke, did not hesitate publicly to admit a multitude of such results—results, indeed, which would shock not only Italian and Spanish Catholics, but many English and American Protestants. According to this interpreter, the Pope had no thought of denying that there are different sorts of documents in the Pentateuch, or the plurality of sources of the books of Samuel, or the twofold authorship of Isaiah, or that all after the ninth verse of the last chapter of St. Mark's Gospel is spurious; and, as regards the whole encyclical, the distinguished Jesuit dwelt significantly on the power of the papacy at any time to define out of existence any previous decisions which may be found inconvenient. More than that, Father Clarke himself, while standing as the champion of the most thorough orthodoxy, acknowledged that, in the Old Testament, "numbers must be expected to be used Orientally," and that "all these seventies and forties, as, for example, when Absalom is said to have rebelled against David for forty years, can not possibly be meant numerically"; and, what must have given a fearful shock to some Protestant believers in plenary inspiration, he, while advocating it as a dutiful son of the Church, wove over it an exquisite web with the declaration that "there is a human element in the Bible precalculated for by the divine."

Considering the difficulties in the case, the world has reason certainly to be grateful to Pope Leo and Father Clarke for these utterances, which perhaps, after all, may prove a better bridge between the old and the new than could have been framed by engineers more learned but less astute. Evidently Pope Leo XIII is neither a Paul V nor an Urban VIII, and is too wise to bring the Church into a position from which it can only be extricated by subterfuges as ludicrous as those by which it was dragged out of the Galileo scandal, or by a policy as tortuous as that by which it writhed out of the old doctrine regarding the taking of interest for money.

In spite, then, of the attempted crushing out of Bartolo and Berta and Savi and Lenormant and Loisy, during this very epoch in which the Pope issued this encyclical, there is every reason to hope that the path has been paved over which the Church may gracefully recede from the old system of interpretation and

quietly accept and appropriate the main results of the higher criticism. Certainly she has never had a better opportunity to play at the game of "beggar my neighbor" and to drive the older Protestant orthodoxy into bankruptcy.

In America the same struggle between the old ideas and the new went on. In the middle years of the century the first adequate effort in behalf of the newer conception of the sacred books was made by Theodore Parker at Boston. A thinker profound and of the widest range—a scholar indefatigable and of the deepest sympathies with humanity—a man called by one of the most eminent scholars in the English Church "a religious Titan," and by a distinguished French theologian "a prophet," he had struggled on from the divinity school until at that time he was the foremost biblical scholar and preacher to the largest regular congregation on the American continent. The great hall in Boston could seat four thousand people, and at his regular discourses every part of it was filled. In addition to his usual pastoral work he exercised a vast influence as a platform speaker, especially in opposition to the extension of slavery into the Territories of the United States, and as a lecturer on a wide range of vital topics. During each year at that period he was heard discussing the most important religious and political questions in all the greater northern cities; but his most lasting work was in throwing light upon our sacred Scriptures, and in this he was one of the forerunners of the movement now going on, not only in the United States but throughout Christendom. Even before he was fairly out of college his translation of De Wette's Introduction to the Old Testament made an impression on many thoughtful men; his sermon in 1841 on The Transient and Permanent in Christianity marked the beginning of his great individual career; his speeches, his Lectures, and especially his Discourse on Matters Pertaining to Religion, greatly extended his influence. His was a deeply devotional nature, and his public prayers exercised by their touching beauty a very strong religious influence upon his audiences. He had his reward. Beautiful and noble as were his life and his life work, he was widely abhorred. On one occasion of public worship, in one of the more orthodox churches, news having been received that he was dangerously ill, a prayer was openly made by one of the zealous brethren present that this arch-enemy might be removed from earth. He was even driven out from the Unitarian body. But he was none the less steadfast and bold, and the great mass of men and women who thronged his audience room at Boston and his lecture rooms in other cities spread his ideas. His fate was pathetic. Full of faith and hope, but broken prematurely by his labors, he retired to Italy, and there died at the darkest period in the history of the United States, when

slavery in the State and the older orthodoxy in the Church seemed absolutely and forever triumphant. The death of Moses within sight of the promised land seems the only parallel to the death of Parker less than six months before the election of Abraham Lincoln and the publication of Essays and Reviews.*

But here it must be noted that Parker's effort was powerfully aided by the conscientious utterances of some of his foremost opponents. Nothing during the American struggle against the slave system did more to wean religious and God-fearing men and women from the old interpretation of Scripture than the use of it to justify slavery. Typical among examples of this use were the arguments of Hopkins, Bishop of Vermont, a man whose noble character and beautiful culture gave him very wide influence in all branches of the American Protestant Church. While avowing his personal dislike to slavery, he demonstrated that the Bible sanctioned it. Other theologians, Catholic and Protestant, took the same ground, and then came that tremendous rejoinder which echoed from heart to heart throughout the Northern States: "The Bible sanctions slavery? So much the worse for the Bible." Then was fulfilled that old saying of Bishop Ulrich of Augsburg: "Press not the breasts of Holy Writ too hard, lest they yield blood rather than milk."

Yet throughout Christendom a change in the mode of interpreting Scripture, though absolutely necessary if its proper authority was to be maintained, still seemed almost hopeless. Even after the foremost scholars had taken ground in favor of it, and the most conservative of these whose opinions were entitled to weight had made concessions showing the old ground to be untenable, there was fanatical opposition to any change. The Syllabus of Errors, issued by Pius IX in 1864, as well as certain other documents issued from the Vatican, had increased the difficulties of this needed transition; and, while the more able-minded Roman Catholic scholars skillfully explained away the obstacles thus created, others published works insisting upon the most extreme views as to the verbal inspiration of the sacred books. In the Church of England various influential men took the same view. Dr. Baylee, Principal of St. Aidan's College, declared that in Scripture "every scientific statement is infallibly accurate; all its histories and narrations of every kind are without any inaccuracy.

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* For the appellation "religious Titan" applied to Theodore Parker, see a letter of Jowett, Master of Balliol, to Frances Power Cobbe, in her autobiography, vol. i, p. 357, and for Reville's statement, ibid., p. 9; for a pathetic account of Parker's last hours at Florence, ibid., i, pp. 10, 11. For the statement regarding Parker's audiences and his power over them, the present writer trusts to his own memory. There is a curious reference to Bishop Hopkins's ideas on slavery in Archbishop Tait's Life and Letters.

Its words and phrases have a grammatical and philological accuracy, such as is possessed by no human composition." In 1861 Dean Burgon preached in Christ Church Cathedral, Oxford, as follows: "No, sirs, the Bible is the very utterance of the Eternal; as much God's own word as if high heaven were open and we heard God speaking to us with human voice. Every book is inspired alike, and is inspired entirely. Inspiration is not a difference of degree, but of kind. The Bible is filled to overflowing with the Holy Spirit of God; the books of it and the words of it and the very letters of it."

In 1865 Canon MacNeile declared in Exeter Hall that "we must either receive the verbal inspiration of the Old Testament or deny the veracity, the insight, the integrity of our Lord Jesus Christ as a teacher of divine truth."

As late as 1889 one of the two most gifted pulpit orators in the Church of England, Canon Liddon, preaching at St. Paul's Cathedral, used in his fervor the same dangerous argument: that the authority of Christ himself, and therefore of Christianity, must rest on the old view of the Old Testament; that, since the founder of Christianity, in divinely recorded utterances, alluded to the transformation of Lot's wife into a pillar of salt, and to Noah's ark and the flood, the biblical account of these must be accepted as historical.

In the light of what was rapidly becoming known regarding the Chaldæan and other sources of the accounts given in Genesis, no argument could be more fraught with peril to the interest which the gifted preacher sought to serve.

In France and Germany many similar utterances in opposition to the newer biblical studies were heard, and from America, especially from the college at Princeton, came resounding echoes. As an example of many may be quoted the statement by the eminent Dr. Hodge that the books of Scripture "are, one and all, in thought and verbal expression, in substance, and in form, wholly the work of God, conveying with absolute accuracy and divine authority all that God meant to convey without human additions and admixtures"; and that "infallibility and authority attach as much to the verbal expression in which the revelation is made as to the matter of the revelation itself."

But the newer movement of thought went steadily on. As already in Protestant Europe, so now in the Protestant churches of America, it took strong hold on the foremost minds in many of the churches known as orthodox: Toy, Briggs, Francis Brown, Evans, Preserved Smith, Moore, Bacon, developed it, and, though opposed bitterly by synods and councils of their respective churches, they were manfully supported by the more intellectual clergy and laity. The greater universities of the country ranged

themselves on the sides of these men; persecution but intrenched them more firmly in the hearts of all intelligent well-wishers of Christianity. The triumphs won by their opponents in assemblies, synods, conventions, and conferences were really victories for the nominally defeated, since they revealed to the world the fact that in each of these bodies the strong and fruitful thought of the Church, the thought which alone can have any hold on the future, was with the new race of thinkers; no theological triumphs more surely fatal to the victors have been won since the Vatican defeated Copernicus and Galileo.

And here reference must be made to a series of events which, in the second half of the nineteenth century, have contributed most powerful aid to the new school of biblical research.

PROFESSIONAL INSTITUTIONS.

V.—BIOGRAPHER, HISTORIAN, AND LITTERATEUR.

By HERBERT SPENCER.

HOW, in their rudimentary forms, the several arts which express feelings and thoughts by actions, sounds, and words, as well as the professors of such arts, originated together in a mingled state, we have seen in the last two chapters. Continuing the analysis, we have now to observe how there simultaneously arose, in the same undifferentiated germ, the rudiments of certain other products, and of those devoted to the production of them. The primitive orator, poet, and musician, was at the same time the primitive biographer, historian, and litterateur. The hero's deeds constituted the common subject-matter; and, taking this or that form, the celebration of them became, now the oration, now the song, now the recited poem, now that personal history which constitutes a biography, now that larger history which associates the doings of one with the doings of many, and now that variously developed comment on men's doings and the course of things which constitutes literature.

Before setting out to observe the facts which illustrate afresh this simultaneous genesis, let us note that in the nature of things there could not be any other root for these diverse growths; and that this root is deeply implanted in human nature. If we go back to a group of savages sitting round a camp-fire, and ask what of necessity are their ordinary subjects of conversation, we find that there is nothing for them to talk about save their own doings and the doings of others in war and the chase. Though they have surrounding Nature and its changes, sometimes striking, to describe and comment upon, yet even these are usually of

interest only as affecting men and influencing their lives. Human actions are the perennially interesting things; and obviously, among human actions, those certain to be most discussed are those which diverge most from the ordinary—the victories of the courageous man, the feats of the strong man, the manœuvres of the cunning man. Thus in the first stages, merely from lack of other exciting matter, there goes, after the narratives of individual successes in the day's hunt or the day's fight, a frequent return to the always-interesting account of the great chief's exploits, his ordinary doings, his strong sayings. Gradually the description and laudation of his achievements grows into a more or less coherent narrative of his life's incidents—an incipient biography. As a reason, too, why biography of this simple kind becomes an early mental product, let us note that it is the simplest—the easiest both to speaker and hearer. To tell of deeds and dangers and escapes requires the smallest intellectual power; and the things told are, fully or partially, comprehensible by the lowest intelligence. Every child proves this. The frequent request for a story shows at once the innate liking for accounts of adventures, and the small tax on the mind involved by conceptions of adventures. And it needs but to note how the village crone, mentally feeble as she may be, is nevertheless full of tales about the squire and his family, to see that mere narrative biography (I do not speak of analytical biography) requires no appreciable effort of thought, and for this second reason early takes shape.

Of course, as above said, biography of a coherent kind, arising among peoples who have evolved permanent chiefs and kings, grows gradually out of accounts of those special incidents in their lives which the priest-poets celebrate. Let us gather together a few facts illustrative of this development.

Its earlier stages, occurring as they do before written records exist, can not be definitely traced—can only be inferred from the fragmentary evidence furnished by those uncivilized men who have made some progress. The wild tribes of the Indian hills yield a few examples. Says Malcolm, "The *Bhat* is both the bard and the chronicler of the *Bhils*." He also states that certain lands of the Bhils were taken by the Rajpoots, and that—

"Almost all the revered Bhats, or Minstrels, of the tribe, still reside in Rajpootana, whence they make annual, biennial, and some only triennial visits to the Southern tribes, to register remarkable events in families, particularly those connected with their marriages, and to sing to the delighted Bheels the tale of their origin, and the fame of their forefathers."

So, too, concerning another tribe we read, in Hislop:—

"The *Pádál*, also named Páthádi, Pardhán, and Desái, is a numerous class, found in the same localities as the Ráj Gonds, to whom its members act as religious counselors (Pradhána). They are, in fact, the *bhats* of the

upper classes, repeating their genealogies and the exploits of their ancestors."

Here, then, the priest is the narrator and his narrative is biographico-historical. It consists of leading facts in the lives of persons, and these are so joined with accounts of tribal deeds as to form a rudimentary history.

In Africa where, for reasons before named, loyalty to the living ruler has not usually given origin to worship of the dead ruler, we meet with only the first stage in the development.

The king of the Zulus has "men who perform the part of heralds in the dances, and who now, at every convenient opportunity, recounted the various acts and deeds of their august monarch in a string of unbroken sentences."

In Dahomey, too, the union is between the courtier and the historian. In that kingdom, where women play so dominant a part, there are, as we have seen, female laureates; and "these troubadours are the keepers of the records of the kingdom of Dahomey, and the office, which is hereditary, is a lucrative one."

From Abyssinia we get an illustration of the way in which the united germs of biography and history make their appearance during burials of notables.

"Professional singing women frequently attend the funeral meetings of great people . . . Each person in waiting takes it by turn to improvise some verse in praise of the deceased." But "the professional singers will give minute details of the history of his ancestry, his deeds, character, and even his property."

When the deceased person is a conquering monarch, this funeral laudation by professionals, the first step in apotheosis, begins a worship in which there are united that account of his life which constitutes a biography and that account, of his deeds which forms the nucleus of primitive history.

From the accounts of ancient American civilizations, facts of kindred meaning come to us. Here is a passage from Bancroft concerning the Aztecs:—

"The preparation and guardianship of records of the higher class, such as historical annals and ecclesiastical mysteries, were under the control of the highest ranks of the priesthood."

Again we read:—

At this assembly the 'Book of God' was prepared. "In its pages were inscribed the Nahua annals from the time of the Deluge . . . religious rites, governmental system, laws and social customs; their knowledge respecting agriculture and all the arts and sciences."

It is instructive to observe how in this sacred book, as in other sacred books, religion, history, and biography were mingled with secular customs and knowledge.

Early civilized societies have bequeathed similar proofs. The biographico-historical nature of the Hebrew scriptures is conspic-

uous. As in other cases, incidents in the life of the national deity form its first subject-matter—how God created various things on successive days and rested on the seventh day. Accounts of his personal doings characterize the next books, and are combined with accounts of the doings of Adam and the patriarchs—biographical accounts. In what we are told of Abraham, Isaac, and Jacob, we see biography dominant and history unobtrusive. But with the transition from a nomadic to a settled life, and the growth of a nation, the historical element comes to the front. Doubtless for a long time the genealogies and the leading events were matters of common traditional knowledge; though we may fairly assume that the priest-class or cultured class were those who especially preserved such knowledge. Later times give some evidence of the connection, as instance these sentences from Kuenen and Neubauer.

"In the eighth century B. C. the prophet of Jahveh has become a writer."

"Upon their return from Babylon, Ezra, called 'the skilled scribe,' made disciples who were called *sopherim*, 'scribes,' and whose business it was to multiply the copies of the Pentateuch and to interpret it. 'Scribe' and scholar' in those days were synonymous."

A few relevant facts are afforded by the ancient books of India. Describing some of their contents Weber says:—

History "can only fittingly be considered as a branch of poetry," both on account of form and on account of subject-matter.

Kalhana, who wrote a history of Kashmir, in 12th cent. A. D. was "more poet than historian."

"In some princely houses, family records, kept by the domestic priests, appear to have been preserved."

From ancient Egyptian inscriptions come various evidences of these relationships. How naturally the biographico-historical element of literature grows out of primitive worship we see in the fact—allied to a fact above named concerning the Abyssinians,—that in an Egyptian tomb there was given in the ante-room an account of the occupant's life; and, naturally, that which was done on a small scale with the undistinguished man was done on a large scale with the distinguished man. We read in Brugsch that—

The Royal gods of the Egyptians, who "are referred to as kings," "have their individual history, which the holy scribes wrote down in the books of the temples."

Here are kindred passages from Bunsen and Duncker:—

Diodorus says "the priests had in their sacred books, transmitted from the olden time, and handed down by them to their successors in office, written descriptions of all their kings." "In these an account is given of every king—of his physical powers and disposition, and of the exploits of each in the order of time."

Priests daily read to the king accounts of the achievements of distin-

guished men out of the sacred books. "We know that poems of considerable extent on historical subjects were in existence."

Thus it is clear that in Egypt the priests were at once the biographers and historians.

Preceding chapters have indirectly shown the primitive connections between religion, biography, and history among the Greeks. The laudation of a god's deeds, now lyrical now epical, rhythmically uttered by his priests, involved with the sacred element both these secular elements. But a few more specific facts may be added.

"The history of the Greek families and states came to be systematically represented in a manner edifying according to the sense of the religion of Apollo and dictated by theocratic interests."

"In and near the sanctuaries the most ancient traditions were preserved."

"A list was kept of the priestesses at Argos and an account of the priestly dignity also of the Kings of Sparta . . . and thus arose historical archives."

And then, after the secularization of rhythmical speeches or songs, first uttered in honor of the gods, the biographico-historical character of their subject-matters is retained and developed. In hexameters, first employed by the Delphic priests, Homer, in the *Iliad* recites a story which, mainly historical, is in no part biographical —the wrath of Achilles being its most pronounced motive. And then in the *Odyssey*, we have a narrative which is almost wholly biographical. But though mainly secularized, these epics have not wholly lost the primitive sacred character; since the gods are represented as playing active parts.

As before said, Roman society, so heterogeneous in its composition, had its lines of normal evolution broken by intruding influences. But still we trace some connection between the priest and the historian. According to Duruy and others—

"The pontiffs were concerned in keeping up the memory of events, as accurately as possible. Thus the Romans had the *Annals of the Pontiffs*, or *Annales Maximi*, the *Fasti Magistratuum*, the *Fasti Triumphales*, the rolls of the censors, etc."

"Every year the chief Pontiff inscribed on a white tablet, at the head of which were the names of the consuls and other magistrates, a daily record of all memorable events both at home and abroad. These commentaries or registers were afterward collected into eighty books which were entitled by their authors *Annales Maximi*."

Further, by its associations, the body of *fetiales* was apparently shown to have had some sacerdotal character.

"By the side of these two oldest and most eminent corporations of men versed in spiritual lore may be, to some extent, ranked the college of the twenty state heralds (*fetiales*, of uncertain derivation), destined as a living repository to preserve a traditionary remembrance of the treaties concluded with neighboring communities."

If, as is alleged, Romulus was regarded by the Romans as one of their great gods, honored by a temple and a sacrificing priest, it seems inferable that the story of his deeds which, mythical as it may have chiefly been had probably some nucleus of fact, was from time to time repeated in the laudations of his priest; and that the speech or hymn uttered by his priest at festivals, had, like the kindred ones which Greek priests uttered, a biographico-historical character.

Though but indirectly relevant to the immediate issue, it is worth while adding that the earliest Roman historian, Ennius, was also an epic poet—"the Homer of Latium," as he called himself. The versified character of early history exemplified in his writings, as also we shall presently see in later writings, is, of course, congruous with that still earlier union of the two, which was seen in the laudatory narratives of the primitive priest-poet.

Of evidences furnished by Northern Europe, we meet first with those coming from the pre-Christian world. Though the stories of the Teutonic epic, *The Nibelungen*, were gathered together in Christian times, yet they manifestly belonged to pagan times; and we may fairly assume were originally recited, as among other European peoples, by attendants of the great—courtiers while these lived, priest-poets after they died. But for a long time after Christianity had been victorious, the Christian narrative alone, in which, as in other primitive narratives, biography and history are united, furnished the only subject-matter for literature, and priests were its vehicles.

"From the fourth to the eighth century, there is no longer any profane literature; sacred literature stands alone; priests only study or write; and they only study, they only write, save some rare exceptions, upon religious subjects."

So, also, the 57 authors named by Guizot as belonging to the 9th and 10th centuries (of whom only five were laymen), were doubtless similarly occupied.

Nevertheless, while the ordinary biographico-historical matter which priests devoted themselves to was that which their creed presented or suggested, there appear to have been, after the 8th century, some cases in which such matter furnished by other than Christian traditions, occupied them; as in the *Rolandslied* and *Alexanderslied*, written in the 12th century by the monks Konrad and Lamprecht.

For the rest it will suffice if we take the case of our own country. Chronicles and histories "were mostly compiled in the monasteries." Taking the illustrations in order, we come first to Bede, who was monk and historian; Cynewulf, bishop or abbot and writer of sacred history; Gildas, monk and chronicler; Asser,

monk and biographer. The Anglo-Saxon chronicle was a year-book of events recorded by monks from the 8th to the 12th century. After the Conquest the chief authors were still ecclesiastics, and their works were usually chronicles or lives of saints. Among them were Marianus Scotus, Florence of Worcester, Eadmer, Ordericus Vitalis, William of Malmsbury, Wace, Geoffrey Gaimar, Henry of Huntington, Fitzstephen, Thomas of Ely, and so on through subsequent reigns, in which the relationship continues for a long time to be marked, but during which the rise of secular competitors in the sphere of literature becomes gradually manifest.

Even without specification of such facts we might safely infer that since, during mediæval days, there was scarcely any culture save that of ecclesiastics, the writing of biography and history was, by the necessities of the case, limited to them.

That fiction has developed out of biography scarcely needs proof. Unless a biographer is accurate, which even modern biographers rarely are and which ancient biographers certainly were not, it inevitably happens that there is more or less of fancy mingled with his fact. The same tendencies which in early times developed anecdotes of chiefs into mythological stories of them as gods, operated universally, and necessarily produced in narratives of men's lives exaggerations which greatly distorted them. If we remember the disputes among the Greeks respecting the birthplaces of poets and philosophers we see how reckless were men's statements and how largely the actual was perverted by the imaginary. So, too, on coming down to Christian times it needs but to name the miracles described in the lives of the saints to have abundant proof of such vitiations. As in our own days the repeater of an anecdote, or circulator of a scandal, is tempted to make his or her story interesting by making much of the striking points; so, still more in early days, when truth was less valued than now, were stories step by step perverted as they passed from mouth to mouth.

Of course the narrator who gave the most picturesque version of an adventure or achievement was preferred by listeners; and, of course, ever tempted to increase the imaginary additions, passed insensibly into a maker of tales. Even children, at first anxious to know whether the stories told them are true, by and by become ready to accept untrue stories; and then some of them, thus taught by example, invent wonderful tales to interest their companions. With the uncivilized or semi-civilized a like genesis naturally occurs among adults. Hence the established class of story-tellers in the East—authors of oral fictions. And how gradually by this process fiction is differentiated from biography,

is shown by the fact that at first these stories which, as exaggerations of actual incidents, are partially believed in by the narrators are wholly believed in by the listeners. In his *Three Years in a Levantine Family* Mr. Bayle St. John tells us that when *The Arabian Nights* were being read aloud, and when he warned those around that they must not suppose the narratives to be true, they insisted on believing them: asking—Why should a man sit down to write lies? So that after fiction comes into existence it is still classed as biography—is not distinguished from it as among civilized nations.

The early history of these civilized nations shows that in the genesis of imaginary biography the priesthood at first took some part. In Henry I's time Wace, a reading clerk, was also a romance writer. So, in the next reign, we have Walter Map, chaplain to the king, who wrote religious and secular romances; and there are subsequently named romances which probably had clerical authors though there is no proof. But the general aspect of the facts appears to show that after that time in England, the telling of tales of imagination became secularized.

Meanwhile derivative forms of literature were showing themselves, mostly, however, having a biographical element. As a writer on Church government the Saxon abbot Dunstan diverged somewhat from the purely clerical sphere; and after the Conquest Sewulf, who, becoming a monk, wrote his travels, gives us a deviation into an autobiographical, as well as a geographical, form of literature. Then in Henry II's reign we have Nigel Wireker, a monastic who wrote a satire on the monks, as did also the chaplain Walter Map, in addition to his volume of anecdotes. Under Richard I there was Geoffrey de Vinsauf, an ecclesiastic who was also a critic of poetry, and Giraldus Cambrensis, who wrote topography. In the reign of Henry III came the monk Mathew Paris, who, in denouncing pope and king, wove biographical matter into a satire. In subsequent reigns Wiclif, John Trevisa, and others, added the function of translator to their literary functions; and some, as Bromyard and Lydgate, entered upon various subjects—law, morals, theology, rhetoric. Here it is needless to accumulate details. It is enough for us to recognize the ways in which in early days the priest took the lead as man of letters.

Of course along with the secularization of biography, history, and literature at large, men of letters have become more diversified in their kinds. History, at first predominantly biographical, has divided itself. There is the unphilosophical kind, such as that written by Carlyle, who thought the doings of great men the only subject-matter worth dealing with, and there is the philosophical kind, which more and more expands history into an account of national development: Green's *Short History* being an example.

Then biography, besides dividing into that kind which is written by the man himself and that kind which is written by another, has assumed unlike natures—the nature which is purely narrative, and that which is in large measure analytical or reflective. And besides the various classes of writers of fiction, laying their scenes among different ranks and dealing with them in different ways—now descriptive, now sentimental, now satirical—we have a variety of essayists—didactic, humorous, critical, etc.

There is little to add respecting the special unions which have accompanied these general separations. Men of letters, taken as a whole, have only in recent times, tended to unite into corporate bodies. The reasons are not difficult to find.

Carried on chiefly in monasteries or by endowed ecclesiastics, the writing of books in early days had not become an occupation pursued for the purpose of gaining a livelihood. Even after the invention of printing there was for a long time no public large enough to make literature a bread-winning profession; and when, at length, books were written to get money, miserable lives resulted: such rewards as could be obtained being chiefly obtained through the patronage of the wealthy. Indeed, it is curious to see how the modern man of letters for a long time continued to stand in the same relative position as did the minstrel of old. He was a hanger-on either of the king or of the great noble, and had to compose, if not in verse then in prose, fulsome laudations of his patron. Only in recent days has he been emancipated, and only by the extension of the book-buying public has it been made possible for any considerable number of writers to make tolerable incomes. Hence, until lately, men of letters have not been sufficiently numerous to make professional union feasible.

Remembering that in France the Academy has long existed as a literary corporation, we may note that in England our generation has witnessed movements toward integration. Forty odd years ago an effort was made to establish a Guild of Literature and Art, which, however, did not succeed. But we have now a Society of Authors, as well as a special periodical giving voice to authors' interests; and we have sundry literary journals which, at the same time that they are organs for criticism, bring the body of authors into relation with the general public.

ONE feature of the work of the national Weather Bureau which is not generally known consists in furnishing transcripts of its records for use as evidence in courts of law. The report of the chief of the bureau states that several hundred such transcripts were furnished in 1893. Cases involving large sums of money often turn upon the state of the weather, which is especially important where perishable goods are damaged in transit.

APPARATUS FOR EXTINGUISHING FIRES.

By JOHN G. MORSE.

DEVELOPMENT OF AMERICAN INDUSTRIES SINCE COLUMBUS. XIX.

[*Concluded.*]

ONE of the most important modern additions to fire-fighting apparatus is the water tower. This invention has so greatly aided in flooding out fires that it will be no exaggeration to say that the date of its introduction marks another era in the history of fire-fighting in this country. Quite appropriately, in the centennial year, 1876, Mr. John Logan, a machinist in the employ of Mr. Abner Greenleaf, of Baltimore, invented a contrivance that was encumbered with the long name of "a portable standpipe fire-extinguishing apparatus." For convenience this term has been shortened to "water tower." Mr. Greenleaf was so sure of the future usefulness of the invention that he immediately made a full-sized machine which was completed in 1879. The apparatus consisted of a firmly built crane-neck truck, in the center of which rested a length of pipe supported on a pair of trunnions. Two more sections of pipe that could be coupled to the first section were carried detached. The three sections measured fifty feet when at full length and were braced with wire ropes. By turning a hand-screw at the back, the trunnions revolved and the pipe assumed an upright position. The nozzle at the top was controlled by guide ropes, and as the pipe was raised the lower end swung under the truck and could be connected to one, two, or three steam fire engines.

The great advantage claimed was that a powerful stream could be directed at short range on a fire in the upper stories of a building when a stream from the ground would spray and strike the ceiling, and when the heat would prevent a fireman from directing a stream from the top of a ladder. The later development and use of the water tower has proved this claim to be well founded. If the buildings opposite a fire are ignited, one sweep of the water-tower stream will be of more avail than several streams from the ground. Many other advantages could be named. The first water tower was put on trial in the New York Fire Department, and was so successful that it was purchased by the authorities. Firemen generally were greatly pleased, and the press lauded the inventor in praiseworthy terms. The Fireman's Journal of September 4, 1880, alluded to the water tower as follows:

"This apparatus is really the only absolutely new appliance

for fire extinguishment that has been invented since the steam fire engine was introduced. There have been improvements in engines, ladders, hose, and rolling stock of all kinds, but of new inventions, original in all respects and of practical utility, there have been none for over twenty years."

Other towers were built for different cities, Boston buying one in 1882 that was destroyed in the great fire of Thanksgiving day, 1889. A few years later Messrs. Ashworth and Petrie, of the Chicago Fire Department, had built in the repair shops a telescoping brass tower of similar description, which is in use to-day in the Chicago Department. In 1888 Chief Hale, of the Kansas City Fire Department, invented a water tower that practically replaced

FIG. 13.—GREENLEAF WATER TOWER.

the Greenleaf. The Kansas City Fire Department Supply Company took up the manufacture of the new machine. Two telescoping square steel shafts rest on trunnions at the forward end of the truck and a chemical engine takes the place of a hand-screw in raising the tower into position. The inner shaft, lined with hose, is raised by cable and pulleys, drawing after it a length of hose that is already attached to receiving nozzles at the base. The delivery nozzle is under perfect control by the aid of guide ropes. The tower is made in different sizes, varying from thirty to sixty feet in height.

In 1893 the Fire Extinguisher Manufacturing Company, of Chicago, placed on the market the Champion water tower, that differs essentially from the Hale tower. This was the invention of their superintendent, Mr. E. Steck, who has done much important work in the way of ladder trucks, chemical engines, and other fire appliances. Hand power replaces the chemical engine in rais-

ing, and the shape of the truck brings the base of the telescopic pipe much nearer the ground, enabling the men in charge to stand on *terra firma*. Two jacks act as adjustable legs to add steadiness while in action. The water connection is made by means of a three or four way Siamese coupling that rests on the ground, thus giving a free course to the stream. This tower can be raised to a much greater height than could previous towers. The above-mentioned company has recently purchased all the Hale patents, and now virtually controls the building of water towers in this country. Every large department in the United States is equipped with one or more towers, and the smaller cities are rapidly following the example. The Davol tower is a very useful contrivance manufactured by the Cornelius Callahan Company, of Boston. It is a curved nozzle attached to a flexible pipe, and can be placed on the upper rungs of an extension ladder. A guide rope enables a fireman to direct the stream from the ground. Recent tests have shown that a great deal of force is lost in a stream from the water tower on account of the friction, and there is still much room for improvement in this piece of apparatus. The small hose reels adopted in the early part of the century were the forerunners of the large and gayly decorated four-wheeled reels used by the volunteer hose companies. After the

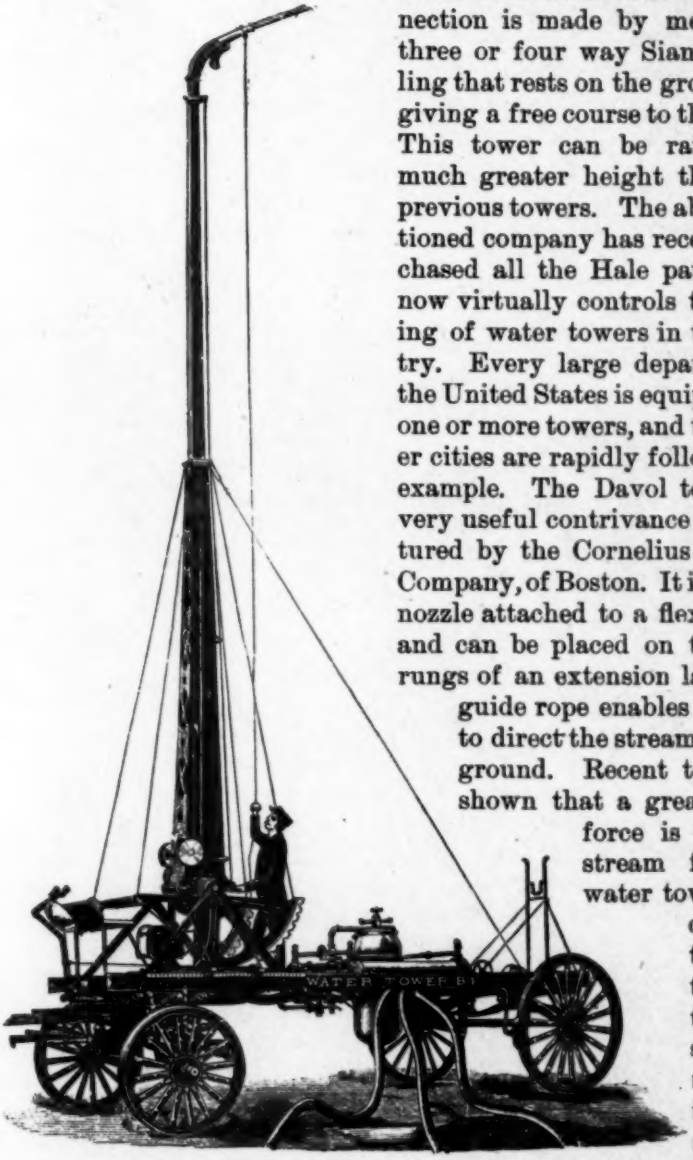


FIG. 14.—HALE WATER TOWER.

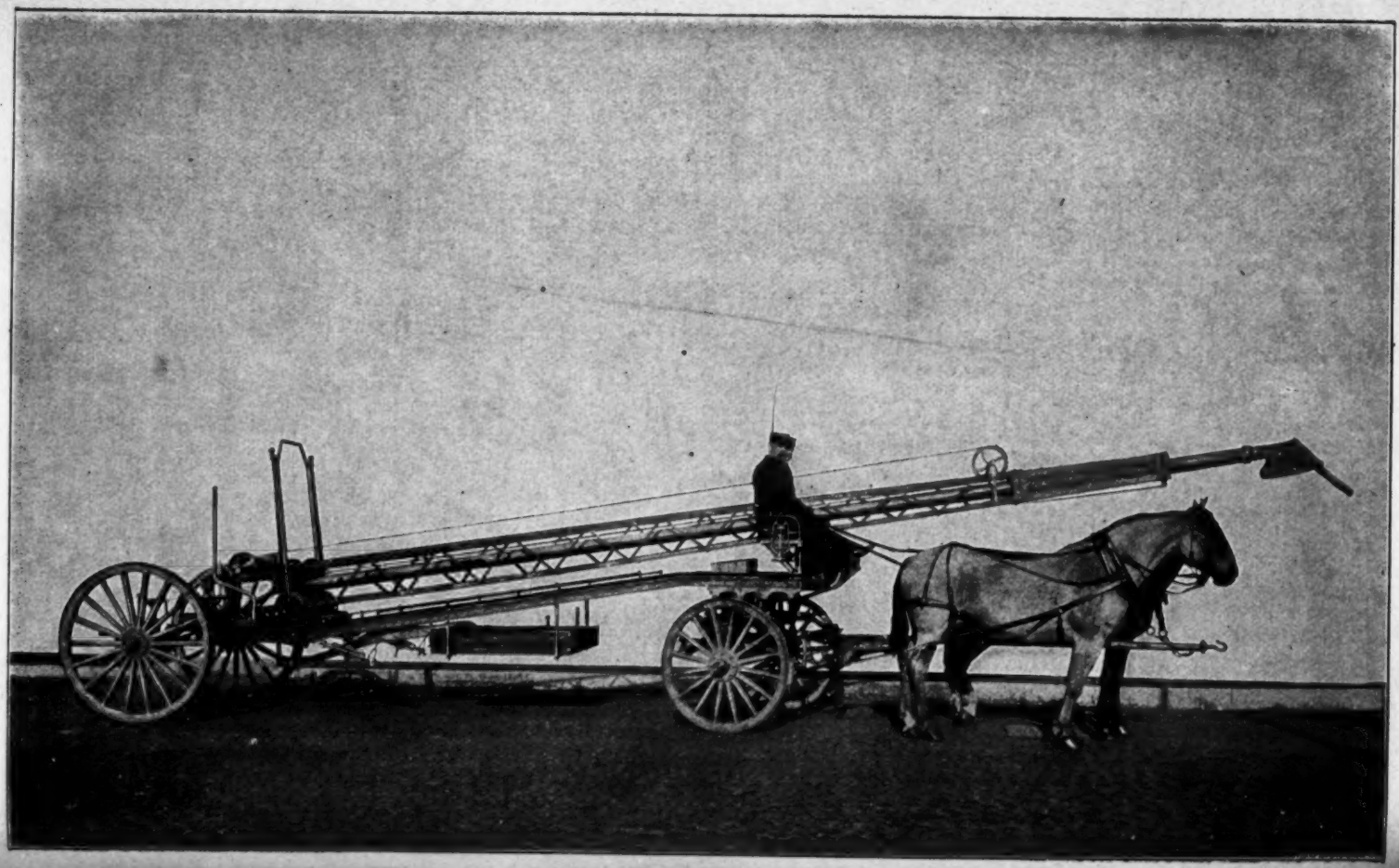


FIG. 15.—CHAMPION WATER TOWER.

introduction of steam fire engines two and four wheeled reels, drawn by horses, were used as tenders. These have been replaced to a great extent by the modern hose wagon. It is claimed that hose can be drawn from flat coils in a wagon with greater rapidity than from a reel, and when once the hose is out the wagon can be used as an ambulance or to bring supplies. It will be impossible to give the names of the manufacturers of hose reels and wagons, for not only are innumerable firms engaged in the business, but often the apparatus is furnished by local carriage builders. All the makers of steam and hand fire engines and ladder trucks manufacture hose wagons and carriages of every variety.

For many years the only hose generally used was made of leather, but to-day this has been practically replaced by either

FIG. 16.—HAND HOSE CARRIAGE.

rubber or fabric. Samuel Eastman & Company, East Concord, N. H., make a specially tanned leather hose that is riveted together in such a manner that the friction is reduced to a minimum. The nature of the material makes it possible to place permanent leather straps at frequent intervals, thereby aiding the firemen in handling.

Rubber hose is made by combining fabric with solid rubber. In heavy hose an inner lining of rubber is combined with light cotton, and an outside lining is combined with heavier cotton. These two are firmly cemented together with the laps on opposite sides. It has been seen that fabric hose was invented in Holland in 1672, but generally discarded as being impracticable. The early canvas hose of this century was made of sail cloth riveted together, and was never very successful. The jacket hose of to-day is woven seamless and lined with rubber. Another seamless

FIG. 15.—CHAMPION WATER TOWER.

jacket is pulled over this, and as many more as may be desired, the heaviest hose being four or five ply. The fabric is treated with chemicals that it may be rot-proof, and the rubber lining is either made by cementing in a sheet of rubber, thereby making one long seam the length of the hose, or by a patented process, in making a seamless lining from melted rubber. The number of companies in the United States engaged either wholly or partly in the manufacture of rubber or fabric fire hose is too numerous to mention.

Fire hose must not only stand the heavy pressure of the powerful streams, but it must not be affected by the wear and tear of being drawn over rough pavements and around various corners while the heavy pressure is on. It must not absorb so much water

FIG. 17.—HOSE WAGON.

from the outside that it becomes too heavy to handle, nor should it be of a nature to allow mud to adhere to its surface. The interior lining must be absolutely smooth, as the slightest friction materially affects the force of the stream. Fire hose has to be washed in a washing machine, and then dried by hanging in hose towers, after every fire, otherwise the length of its life would be greatly lessened.

Suction hose is of large diameter. It is made of heavy rubber, and wound either inside or out with round or flat wire to give it strength. When water is drawn from a hydrant the suction hose is coupled to an opening of its size, but a large strainer is always carried to use when taking water from the harbor, lakes, etc.

There are a great many different hose couplings in use, both screw and snap. The Rhode Island Coupling Company, of Providence, and many other firms engaged in the manufacture of other apparatus, furnish the screw couplings. The National Coupling Company, of Pomona, Cal., has introduced a very serviceable

snap coupling that fastens with a catch, needing no screw. The representative firemen of this country have tried for many years to adopt a universal coupling, as a difference in screw threads often causes serious delays. Owing to the enormous expense that would be incurred in changing every department to one standard, the efforts in that direction have so far been unsuccessful.

FIG. 18.—PERFECTION NOZZLE-HOLDER.

The Siamese coupling is a very simple contrivance that has one large opening on one side, and two, three, or four smaller openings on the other. By use of this, several fire streams can be converted into one powerful body of water. In some cases these couplings are provided with valves so that one or more of the different lines of hose can be shut off if necessary. The Siamese coupling has been referred to in connection with the Champion water tower. A reducing coupling is also made by which a hose of large diameter can be coupled to a smaller line, and thus prevent water damage at an incipient fire.

Hose nozzles have been varied to suit about every requirement of the firemen. The outlets of the ordinary nozzles vary, being in some cases a smooth bore, and in others lessened in size by a ring. The larger nozzles are sometimes provided with an inner tube that will make a division in the stream, and therefore tend to close the stream on itself and prevent spraying. In some cases the nozzle is divided into sections to destroy the revolving motion of the stream, and one nozzle is made with a small hollow tube in the center. The stream having an air space, closes upon it and hangs together for a longer time. The solid body of the noz-

FIG. 19.—SECTION OF NOZZLE SHOWING RING.

zle is generally wound with cord to give better holding surface, and again the solid body is replaced by a flexible pipe made of cotton-lined rubber wound with wire. This device enables the fireman to change the direction of the pipe when at close quarters. Spray and shut-off nozzles are used that can instantly reduce the size of the stream or change it into a fine spray. The ball nozzle is one of the latest inventions in this direction. A funnel-shaped opening contains a ball that, when not in use, is held in place by a light staple. When the stream is playing, however, the ball is forced into the opening by outside pressure and an extensive spray is the result. The cellar pipe is a modification of an ordinary nozzle. Being bent and in some cases formed in the shape of a letter S, it can be thrust through the floor and the stream easily delivered in any direction. A similar contrivance is used to extinguish a blaze between the ceiling and roof of a flat-roofed building. The distributing nozzle consists of a metal globe provided with several nozzlelike outlets. This globe is attached to the end of a line of hose, and the force of the stream causes it to revolve and distribute a number of small powerful streams in every direction. This is especially efficient when hung in a subbasement that is filled with smoke. There are also small sprinkling nozzles used to clear a smoky room.

The enormous force of a fire stream renders it a difficult matter to retain control, and many are the accidents reported of firemen who have been disabled by failing to hold the nozzle. The Perfection nozzle holder, manufactured by Samuel Eastman & Company, of East Concord, N. H., is composed of two bars between which the nozzle lies securely strapped. Two handles are on each side, and a removable bar is carried, that can be let down to the ground as a brace. An inner ring at the end of the nozzle, called the Hopkins patent, destroys the twisting tendency, and the ground brace carries off any electric current with which the stream may come in contact. One man can safely direct a stream that ordinarily would require two or three to hold it.

Breaks in hose are mended by strapping a prepared sleeve to the injured part, or inserting a convex brass plate under the break and clamping to it a corresponding concave plate from the outside. To facilitate pulling hose up a ladder, through a window, or over the edge of a roof, a simple hook-shaped frame, provided with rollers, called the Bresnan hose hoist, is used.

The absolute shut-off nozzles can not be used without bursting the hose, unless the engine or hydrant is provided with an automatic relief valve that will open and allow the water to run back into the suction pipe. The valve can be regulated to suit the pressure that the hose will stand. During the sixties several valves were tried, the first very successful one being that invented

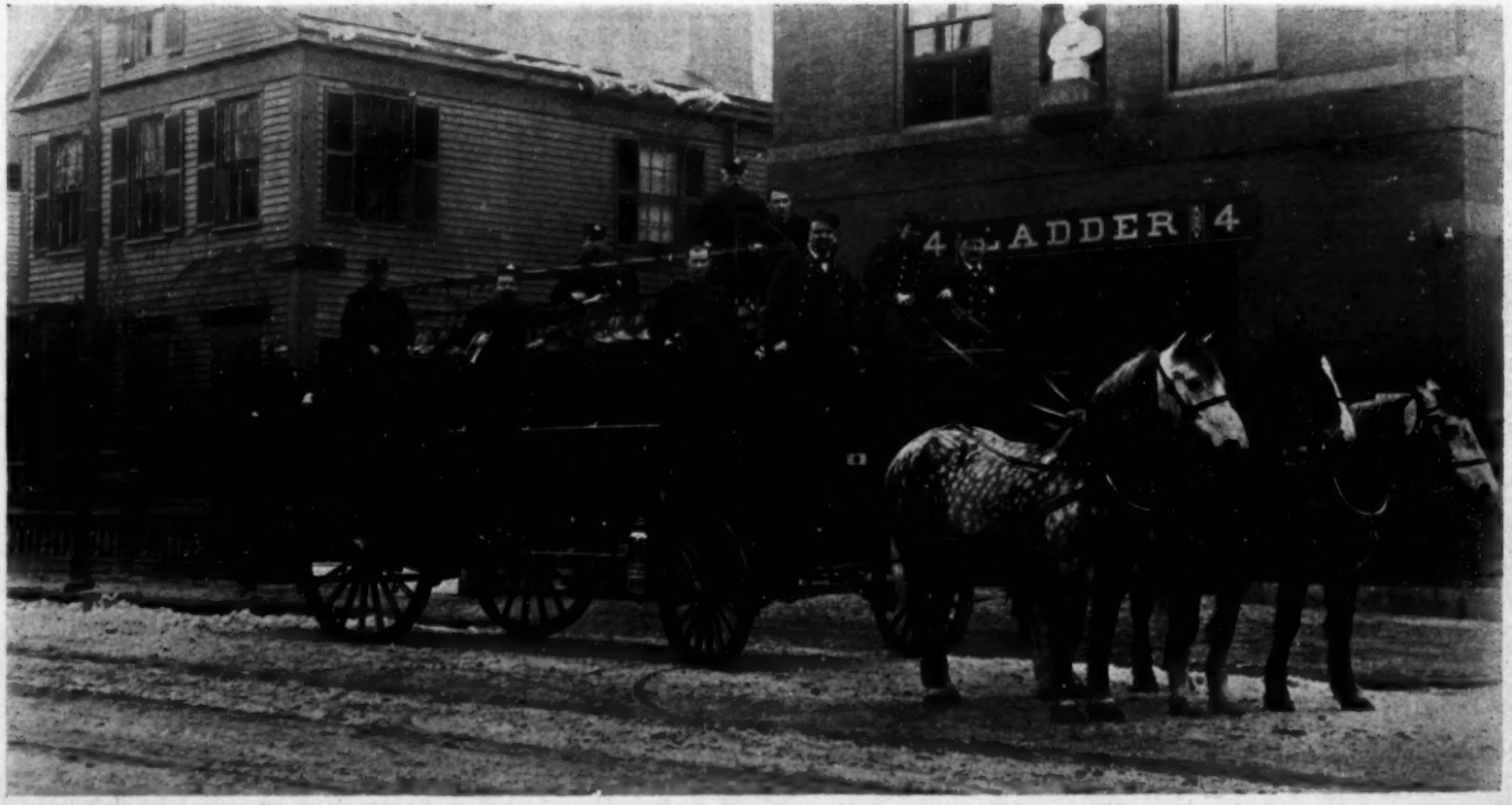


Fig. 20.—Ordinary Ladder Truck.

by Mr. Alvarado Mayer, a member of the Detroit Fire Department, in 1869. Mr. L. D. Shaw, of Boston, also introduced a successful valve in 1874. Since then there have been a number of different valves in use. Mr. Cornelius Callahan, of Canton, Mass., perfecting one in the neighborhood of 1888. These three are about the only ones in general use to-day.

It has been seen that the first ladder trucks were introduced at the beginning of this century, and the patterns then adopted have been followed more or less to the present day. Portable escapes were invented by the score, some in the form of extension ladders, others as lazy tongs, and others in the form of cranes, by which a bucket could be raised and lowered. None of these came into general use, because they had not reached a stage of development at which apparatus of that nature could be made light and strong enough to be practicable. The ordinary ladder truck consists of a long frame, with crossbars at different heights provided with rollers. These are equipped with several ladders of different lengths, and an extension ladder. The latter is a combination of ladders that slide over each other by means of a chain and pulley. The whole length is rested against a building, and the center is supported by props. The Bangor Extension Ladder Company and several others make ladders of this kind. The Gleason & Bailey Manufacturing Company, the Stewarts, C. T. Holloway, Seagrave & Company, P. J. Cooney, and some of the engine-makers, manufacture ladder trucks that differ simply in minor details too numerous to describe.

The aërial truck consists chiefly of an extension ladder that rests on trunnions on a turntable at the forward end of the truck. The extension ladder is raised in much the same manner as is the water tower, and when erect is capable of supporting itself with several working firemen without resting against a building. The Hayes, the Gleason & Bailey, the Arrow, and the Babcock are among those well known. The aërial trucks carry a full complement of ladders.

The largest ladder trucks are provided with a steering wheel over the rear axle to facilitate the turning of corners, and Mr. Steck, of Chicago, has invented a depressed rear axle which lends stability to the truck, while a lever in place of a steering wheel directs the rear wheels.

In addition to the regular ladders, a variety of apparatus is carried on every truck. The axes, or hooks as they are called, are too well known to need description. In olden times large, heavy hooks were used to tear down buildings, but these have since been abandoned. It is interesting to note in this connection that as late as 1857 the Scientific American published an illustration of an enormous hook mounted on wheels. The hook was intended

to be attached to a house and pulled by a crowd of men until the house collapsed. Probably a hook of this nature was never used. The firemen of to-day extinguish a fire instead of being content to stop it within certain boundaries, unless an extensive conflagration renders it necessary to raze buildings by dynamite. The hooks of to-day are used to cut through into a hidden fire, and for other purposes of like nature.

The pompier or scaling ladder is a most necessary article, and is used in connection with the distinct pompier service. Christ Hoell, of St. Louis, who had served in European pompier companies, believed that the system could be advantageously introduced into this country. In 1877 he formed a volunteer company in St. Louis, and drilled the men in the use of the apparatus connected with the system. The members of the city government were so pleased with the exhibition given by this volunteer company that the system was introduced into the fire department, under Chief Engineer Sexton, in December of the same year. Since then the pompier service has found its way into all large departments, and many cities support training schools that every fireman may be thoroughly drilled. The pompier ladder is made of one pole, from twelve to eighteen feet long, provided with cross-rungs. At one end an iron hook projects at right angles from two to three feet. By the aid of this ladder one man can scale the side of a building by putting the hook over a window-sill above, climbing the ladder, and repeating the operation. If flames are coming from the window directly above, the window at the side is used, and the fireman has to swing into position by the aid of his ladder. Two men with two ladders can climb together much more speedily, as they take turns in steadying each other's ladders. The pompier fireman wears a belt, in the front of which is a snap-hook. He also carries a hatchet and a coil of rope one hundred feet long. By fastening the rope to some convenient point, and taking two turns round the snap-hook, he can descend rapidly and safely. If carrying a person with him, another turn of rope is taken round the hook. A long canvas chute is sometimes carried, through which inmates of a burning building can slide to the ground.

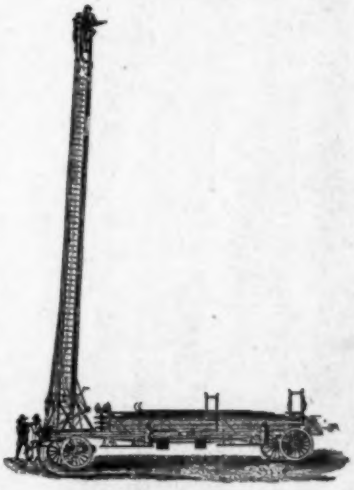


FIG. 21.—AERIAL TRUCK.

The "grip-sack," or what is more generally called the life net,

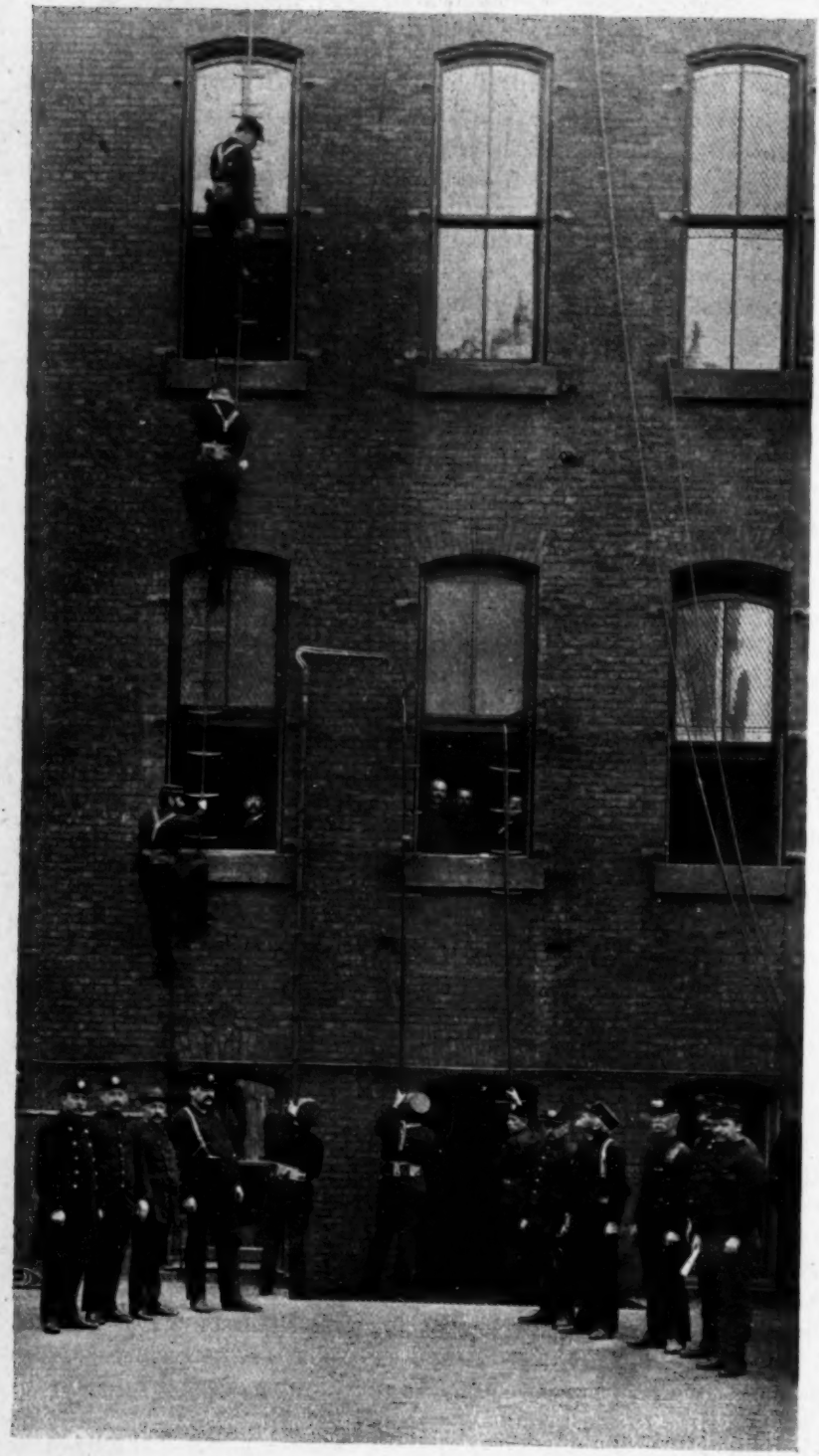


Fig. 22.—Scaling a Building with Pompier Ladders.

is a piece of leather-bound canvas, ten feet square. Handles along the sides enable a group of firemen to hold the net taut to catch any one who may jump from above. The life net did not originate in this country with the pompier service. Canvas nets have been in use for some time, and at the present day their place is being taken by circular rope nets that are more yielding. Being formed in a circle, each man obtains a direct pull from the center. The Hunter net is composed of a spiral of rope, and the Empire net is made of concentric circles of rope, the ropes in each case being supported with radial lines. It is a most difficult matter to hold a life net securely and receive the shock of a falling body. When a man has jumped from an upper story, possibly sixty feet above the street, and his helpless body suddenly emerges from a cloud of smoke and flame that is pouring from lower windows, the firemen must instantly have the net directly under him and then brace themselves to receive the shock. The pompier ladders, etc., are also often carried on hose wagons, that every chance may be given to put them in use at the earliest moment.

There are several other articles carried on ladder trucks. The life gun or life pistol is used to shoot a slug or arrow, to which is attached a loosely coiled rope, over the roof of a building. The inmates can then pull up a stronger rope and descend to the ground. There are also short roof ladders with hooks to cling over the ridge-pole, and some departments carry a tripod ladder that may be stood under an electric wire, where a fireman with insulated shears can remove the dangerous obstruction. This ladder is the invention of Captain Griffin, of the Boston Fire Department. The ram, a heavy battering pole worked by three or more men, held a place in departments for a long time, and was used to batter down doors, etc. This is being replaced to a great extent by the Detroit door opener, a simple prying device which rips the entire lock out of place or the door off its hinges in a shorter space of time than that in which the same could be battered down. Ladder trucks are also provided with chemical extinguishers, rubber blankets, medicines for burns, and several sundries.

Although the protective departments had a forerunner in some of the early fire companies whose members carried canvas bags to be used in saving property, the insurance companies did not introduce their patrols or salvage corps for several years later. Some of the insurance companies of New York in 1839 organized a corps of bagmen, who saved what they could of endangered property. Later a two-wheeled hand wagon, supplied with half a dozen rubber covers, was put in service. Later a permanent station, equipped with a four-wheeled wagon, drawn by

horses, was established. To-day there are several stations with nine wagons and a Silsby steam fire engine, which latter is used to pump out cellars. In Boston, as early as 1849, the insurance firm of Dobson & Jordan employed some men to carry bags holding oil covers. In 1858 these were carried on Ladder No. 1. In 1868 an old milk wagon was purchased by the insurance companies and filled with covers, brooms, shovels, etc. A regular protective department was established in 1870. The insurance companies in all large cities now support protective departments, and in some places an effort is now on foot to merge them into the regular fire departments.

All departments are equipped with supply wagons that resemble hose wagons in their construction and carry baskets of coal, extra hose, etc., to every fire. In 1879 the New York department built a wrecking truck. The Boston department built

FIG. 23.—WRECKING TRUCK.

a similar truck in 1893. So far as learned, these are the only distinct wrecking trucks in use. The truck is long and low and supplied with a variety of tools for making repairs on apparatus at a fire. An extra wheel, hose, nozzles, etc., are also carried. On one side of the truck is a vise, and on the other a chemical extinguisher.

In 1883 the New York City Department tried the experiment of building a five thousand gallon tank, mounting it on wheels and drawing it to some place between the water front and a fire, that the fire-boats might pump into it and the engines draw therefrom. The apparatus proved unsuccessful, however, and has been abandoned.

The wheels used on fire apparatus have to be of unusual strength to stand the heavy weights, great speed over rough pavements, slewing in car tracks, and other strains that would demolish ordinary wheels. In the Archibald wheel the tire, spokes, and hub are put together under heavy pressure. The

hub is of malleable iron, from which a flange extends on the inner side of the wheel. An outer removable flange is bolted through the spokes to the inner flange. The Sarven wheel has a wooden hub with an outer and inner flange that are pressed into position and then bolted through the spokes. The Warner wheel has a wooden hub upon which is shrunk a solid metal band with openings to receive the spokes. The spokes are driven through the openings into mortises cut in the hubs to receive them. The Archibald wheel is made by a company of that name in Lawrence, Mass. The Sarven and Warner, and some other wheels not described, are made by several different firms.

A distinct feature of American fire apparatus is the swinging harness, which is too well known to need description. There are several kinds in use, and much conflicting testimony uttered in regard to their priority. In a decision rendered by the United States Circuit Court, sitting at Kansas City, Mo., it was stated that swinging harness was used as early as 1843 by Dr. B. F. Whitney, of Loudonville, Ohio; in 1871, by the fire departments of Allegheny City, Pa., and St. Joseph, Mo., and by the Hughes Brewery, Cleveland, Ohio; and in 1872, by the Louisville (Ky.) Fire Department. The writer is informed by Major Edward Hughes, chief of the Louisville department, that Mr. Thomas Pendegrast, a member of that department, invented the first harness used there. Mr. Edward O. Sullivan invented a swinging harness in 1875, which was first manufactured by the Worswick Manufacturing Company, and also by Isaac Kidd, of Cleveland. In 1880, Mr. Charles E. Berry, of Cambridge, Mass., invented a harness which he still manufactures; and in 1885, Chief George C. Hale, of the Kansas City Fire Department, invented a harness that is now manufactured by the Fire Department Supply Company of that city. The sliding pole, by which firemen facilitate their descent from the second story of the engine house, was invented by Captain B. F. Bache, of the Louisville Fire Department. In nearly all engine houses the steamers are kept connected with boilers, and an automatic lighter kindles the fire as the engine starts in response to an alarm.

When it was first found necessary to have some warning signals upon fire apparatus, tinkling bells were used, and in many cases a fireman would run ahead, blowing a bugle. The introduction of horse cars made bells so universal in our streets that clanging gongs were substituted in their place on apparatus. The cable and trolley cars of to-day being exclusively provided with gongs, in many instances the fire officials have returned to the use of tinkling bells, although the bugle is still used.

The use of sail cars, introduced in Salem, Mass., and vicinity in 1774, was continued as late as 1843. The Scientific American

of 1857 illustrates a truck carrying a roll of sheet iron that can be raised to form a screen; and in 1872 another is pictured composed of plates that can be raised one above another. The modern high buildings make such apparatus useless at the present time.

The numerous hand pumps would not receive notice here, were it not for the fact that one of them has been incorporated into a regular fire department. The Johnson pump, made by the National Manufacturing Company of Boston, is composed of a vertical cylinder and piston, provided with an air chamber. A short piece of hose that can be held in the hand is attached near the top. The pump is placed in a pail of water, and an adjustable clamp enables the operator to steady both pail and pump. Mr. Joseph Bird, in his interesting book entitled Protection against Fire, emphatically advocates the extended use of this pump, in addition to the existing apparatus. The experiment has been tried in Wakefield, Mass., with gratifying results. Almost a hundred of these pumps are owned by the town authorities and distributed in easily accessible places over the town. Every year a majority of the fires are quenched in their incipiency by some citizen with the aid of one of the pumps, and the steam fire engine is therefore seldom called upon to answer an alarm where a moment's delay might result in a large fire. The United States Government uses these pumps for the same purpose in armories, etc.

Some experiments have been made in the way of running an electric wire with each line of hose, that a fireman with a telegraph key or push-button at the nozzle may notify the engineer by telegraph or prearranged bell signals when to turn the water on and off, when help is needed, etc. The idea is a good one, but as yet has not been entirely perfected, as in dragging a line of hose through a burning building the wire may become broken at a critical moment when it is most needed.

Bicycles are being introduced in some European departments to enable the men to reach the fires as soon as possible. In some cases small chemical extinguishers are attached. As yet very little has been done in this line in America. The hose wagons and ladder trucks so well accommodate the men that the need of bicycles has not been greatly felt.

It does not come within the scope of this article to mention the fire-alarm telegraph, the stationary fire equipment of buildings, fire escapes, etc. It is also hardly necessary to mention the numerous lanterns, trumpets, uniforms, and other objects of like nature. The historical data at the beginning of the article are doubtless incomplete, for historians generally give very little attention to the primitive methods that were so long in use in

every city. The American fireman is to-day equipped with the finest apparatus in the world for extinguishing fires and saving life, but he is badly handicapped by the town and city governments on every hand, who will not modify loose building laws or strengthen slight fire restrictions.*

VARIATION IN THE HABITS OF ANIMALS.

By GERTRUDE CROTTY DAVENPORT.

IN the introduction to his Animal Life as Affected by the Natural Conditions of Existence, Carl Semper wrote, in 1879: "It appears to me that of all the properties of the animal organism, Variability is that which may first and most easily be traced by exact investigation to its efficient causes; and, as it is beyond a doubt the subject around which at the present moment the strife of opinion is most violent, it is that which will be most likely to repay the trouble of closer research."

Among other sorts of variability discussed by Semper, that which concerns the change of food habits of animals receives consideration, and several examples illustrating such changes—polyphagy—are cited. For instance, on page 62 the story of the New Zealand parrot (*Nestor mirabilis*) is told. This parrot, which formerly fed upon the juices of plants and flowers, has acquired the habit of sipping the blood of newly slaughtered sheep, and thereby has come to develop such a love for the taste of blood that it will now alight upon living sheep and peck at the "most minute wounds." Another case is told of two horses in Chili which had developed the habit of eating young pigeons and chickens.

A great many other interesting cases of variability in food habits might be collected by a little observation and by compilation. Two such cases at least have come under my own observation. On a farm in Coffey County, Kansas, a few years ago, there

* In compiling the data for this article the writer wishes to acknowledge the services rendered by all the manufacturers of fire apparatus, especially the American Fire Engine Company, the La France Fire Engine Company, S. F. Hayward & Company, and the Gleason & Bailey Manufacturing Company. Also the personal assistance of the chiefs of the Bangor, Boston, Hartford, New York, and Louisville Fire Departments; Mr. James R. Newhall, the Lynn historian; Mr. Arthur W. Brayley, author of the History of the Boston Fire Department; Mr. Albert C. Winsor, Secretary of the Providence Veteran Fire Association; Mr. Amos Perry, Secretary of the Rhode Island Historical Society; Mr. A. D. Nickerson, Pawtucket; Mr. William Cowles, of the Cowles Engineering Company; Mr. Talcott Williams, of the Philadelphia Press; Mr. Abner Greenleaf, of Baltimore; and Mr. E. Steck, Superintendent of the Fire Extinguisher Manufacturing Company, of Chicago.

were several horses and mules which greedily devoured the eggs laid in their mangers by improvident hens. I believe that this habit is not uncommon. At any rate, I have been told of several instances in which this same practice has been acquired by other horses. Also upon this farm, during the winter of 1887, a milch cow and a fully grown pig were shut up together in the same lot. This cow, which had been furnishing milk bountifully, suddenly, about a month after her confinement in the lot with the pig, ceased to supply milk at all. At first she was accused of "stubbornly holding her milk," but after several days it was decided that some one was stealing her milk. A careful watch was then kept, and the thief proved to be the pig.

Another kind of variability which is displayed by wild birds has received not a little attention from ornithologists—namely, that which they exhibit in their nesting habits. From the observations of Coues, Ridgway, and Allen, we learn that not only in regard to the place, but also in regard to the manner of building their nests, do birds display considerable variation. Also we know that among wild birds the male aids much more in the rearing of broods than do the males of our various domestic fowls. The wild male often takes turns with the female in sitting on the incubating eggs, and in some instances the male assumes the entire responsibility of rearing a hatched brood while his mate builds a new nest and lays another set of eggs. Domestication seems to have obliterated much of this parental instinct in our male fowls. When, perhaps by reversion, we find such instinct to be developed in our domestic male fowls, we are at once impressed by the unusualness of the occurrence. I know of no instance recorded in which parental instinct seemed to be so fully developed in the male of any of our domestic fowls as in the following case. In the poultry yard upon a farm in La Salle County, Illinois, there was but one pair of turkeys. The hen, one spring, stole away, made her a nest in some hiding place, and in due time began to incubate her eggs. After her disappearance the male became exceedingly lonely. Sometimes he would follow her in her tortuous retreat to the nest after a visit to the house for food; but he returned later, more disconsolate than ever. He strove to make friends with the other fowls, but found none which seemed to realize his loneliness and give him sympathy or affection. After ten days or so of this dreary neglect he gave up in despair and began to sit upon a deserted nest of hen's eggs which he discovered under some shrubbery in a corner of the lawn. From that time on he seemed as contented, important, and preoccupied as any sitting hen. He would not leave the nest until driven by absolute need of food and water. Then he would run to the feeding-pans, greedily swallow a few grains of corn and a gulp of

water, and dive again for his nest. As soon as his owners felt convinced that he wished to rear a brood of his own, he was supplied with fresh hen's eggs. He continued thus to persist in his conduct for more than two weeks. Then the turkey hen appeared in the poultry yard with her brood. During that day the male turkey was observed to take food frequently. His visits to the poultry yard became more and more prolonged, while the intervals spent upon the eggs grew shorter and shorter, until finally, after the elapse of two or possibly three days, the nest of hen's eggs was abandoned altogether. From that time on he shared with the turkey hen the care of the brood of his own kind. The abandoned eggs were placed under a hen and hatched in a few days. This instance is not without interest as it stands, but it is much to be regretted that the eggs did not hatch while the male turkey sat upon them. Would he have abandoned his living brood with the same or with more reluctance than he showed in deserting the eggs, or would he have reared his adopted offspring?

One other most remarkable instance of a change of habit came under my observation also in Coffey County, Kansas. The individuals which showed a change of habit in this instance were birds in the wild state—namely, blue jays (*Cyanocitta cristata*). I say *individuals*, for a score or even scores of blue jays were concerned. These all adopted the same peculiar practice in their warfare with the so-called English sparrow (*Passer domesticus*), and, moreover, have preserved this habit for at least three successive years.

Since the arrival of the aggressive English sparrow much apprehension has been felt by bird-loving Americans regarding the fate of native American birds. As the area of distribution of the English sparrow rapidly widened, just so rapidly our native birds seemed to be brought into violent conflict with the garrulous stranger, or else they were driven to abandon to the newcomer their nesting sites and retire into the forests or prairies. The question arose as to whether the English sparrow itself on account of numbers would be driven from the cities and towns to take up nesting sites about country barns and farmhouses. The Report of the United States Department of Agriculture for the year 1889 on The English Sparrow (*Passer domesticus*) in North America, especially in its Relation to Agriculture, contains communications from many parts of the country testifying, not only to the destruction wrought by this sparrow in gardens and upon ripening grain fields, but also to the fact that few American birds seem to be able to resist the aggressions of this sparrow, and many therefore are compelled to abandon their nests to the intruders, even after their eggs have been deposited or are in process of incubation.

But the relations of our native birds to the English sparrow seem now to be undergoing a change. F. H. Kimcoll (Auk, vol. vi, July, 1894, p. 261) has stated that in many localities in Illinois the English sparrow and native birds are now found nesting side by side, where only a few years ago the English sparrow occupied all the desirable nesting sites, and assumed so aggressive an attitude toward native birds that one rarely saw a native bird nesting in the regions inhabited by the English sparrow. "Either," he writes, "our native birds have unexpectedly developed powers of resistance at first unsuspected, or the pugnacity of the English sparrow has diminished, for certainly our own songsters have not been driven away, but, on the contrary, seem as numerous as they were twenty years ago. For the past two or three years, since my attention was first called to the matter, I have seen but little if any persecution of our native birds by the foreign sparrows; on the contrary, our own birds are now often the aggressors, and if they do not indulge in persecution themselves are adepts at defense. Very commonly a jay, robin, or catbird will from pure mischief hustle a flock of sparrows into desperate flight."

I find, on referring to the Government report of 1889, that the English sparrow has been present in the town of Burlington, Kansas, for ten or twelve years. My own attention was not attracted particularly to these birds until after they had been there for several years. Upon returning to Burlington in 1889, I began to look about upon the lawn for my old bird friends, and found none of them. Upon inquiry, I was told that they had all been driven away by the English sparrow. The wren house was occupied by sparrows. The martins, robins, bluebirds, and catbirds had all resisted according to their various strengths, and had been worsted in the conflict. The lawn under consideration is one peculiarly attractive to birds on account of its bountiful supply of shade trees. There is a long walk upon it completely shaded by apple and pear trees, of which the ripening fruit proves attractive to insects all summer long, while the fruit itself is no less enticing to bird than insect. On one side of the lawn there are cherry trees with their tempting fruit, and on the adjoining lots a large kitchen garden with its ripening seeds, berries, and freshly turned loam. Altogether this place furnishes a paradise for parent birds. The house itself was covered with vines of the Virginia and trumpet creepers. Within these vines the English sparrow took up its abode and soon so increased in numbers as to be able to mob any other bird that ventured on the premises. Only one pair of blue jays stubbornly clung to their nest in an apple tree. With this pair was throughout the summer waged one long and bitter warfare.

Upon my return the following summer the number of jays had increased and the conflict was much less one-sided. In June, 1891, early the first morning after my return again to Burlington, I heard on the lawn the screeching of a hen hawk. The English sparrows shot in terror into the verandas and among the vines upon the house. Upon inquiry, I was told that the hawks had been chasing the sparrows all spring, and was assured by our colored cook that "dis country am comin' to 'struction suh, when de hawks come to town." I had never known of an instance where hawks had entered a town several miles in area, and supposed that they were made so bold on account of the attraction such an abundance of sparrow food afforded. The cry of the hawk, however, seemed shriller and more satanic than any hawk cry I had ever heard before. Indeed, there was a suggestion of a mocking laugh in these hawk screams. I wondered if this change in tone was due to the new environment of the hawk, to the fact that it was dealing with such helpless prey, or whether the cry came from a hawk new to me.

With these questions in mind I watched carefully for days, without even catching a glimpse of the hawks, although they screamed at intervals all day long among the trees. Each time the demonic scream began the sparrows seemed almost paralyzed with terror, and the hens would hustle their broods into the barn or under the shrubbery. One day, while lying in a hammock watching some sparrows devour a fallen apple, I was startled by the screams of a hawk in the tree just above me. Upon looking upward I discovered that my elusive bird was no other than a blue jay. The fallen apple was abandoned by the sparrows in their fright and the jay sought its nest in a tree near by. For several weeks longer the blue jays always concealed themselves in the trees before they gave their adopted yell, but later in the summer they did not even take the precaution of alighting in the trees before screaming, but sat boldly in view upon the fence, screamed while in flight, and even followed the sparrows into their retreat among the vines. In a few instances they destroyed the sparrows' eggs or young.

For a time the ability thus to imitate the hawk seemed to be confined to the blue jays nesting upon this one lawn. Ofttimes these blue jays would rush to the rescue of other blue jays on neighboring lawns. Eventually, however, other blue jays learned the cry, and in the following summer I heard it on the other side of the town some two miles or more away. The second summer after this imitation of the hawk began, other native birds returned in small numbers. The blue jays often made themselves champions of these returned exiles. The other birds, however, soon learned to resist the English sparrow on their own account.

About a year ago the vines were almost entirely torn away from the house, and in consequence the English sparrow, having no place of refuge from the blue jays, has deserted this lawn. The blue jays now seem to take greater pleasure in routing a venturesome sparrow by means of their own natural call, and have recourse to the imitation of the hawk only as a last resort.

The catbird and robin seem to have learned from the blue jay the efficacy of a vigorous, angry call, and now fight successfully their own battles. Last summer a bluebird nested and sang freely in the trees. Even the wrens ventured to build on a beam in the carriage shed, although they seemed very shy and were rarely heard to sing.

In Ornithological Notes from the West, by J. A. Allen (American Naturalist, vol. vi, p. 18), I find the following references to the blue jays which were observed by him at Leavenworth, Kansas: "The blue jay (*Cyanura cristatus*) was equally at home and as vivacious and even more gayly colored than at the north. While he seemed to have forgotten none of the droll notes and fantastic ways one always expects from him, he has here added to his manners the familiarity that usually characterizes him in the more newly settled parts of the country, and anon surprised us with some new expression of his feelings or sentiments—some unexpected eccentricity in his varied notes, perhaps developed by his southern surroundings."

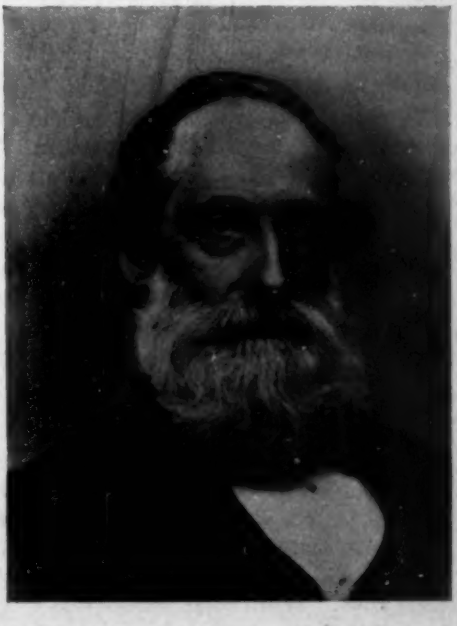
Robert Ridgway, in Volume VIII of The American Naturalist, refers to the above instance and others cited by Mr. Allen. "Mr. Allen," he writes, "has called attention to the variation in the notes of different birds at remote localities; and in this I am able to corroborate him, though I think that cases of such variation are very rare, and do not occur in more than perhaps five per cent of the species. I have only detected it in two or three species after the most careful observation, and in very many cases noticed that there was not in the minutest particular any difference between individuals of one species on opposite sides of the continent. Such is undoubtedly the case in a very great majority of the species, any seeming variation that may be observed being more probably the peculiarity of an individual rather than the manifestation of any regional impress."

The conduct of the blue jays instanced above may be used in confirmation of the three quotations made in this article, for the blue jay has certainly in this instance "developed powers of resistance at first unsuspected," which certainly aid it in its warfare with the English sparrow. Moreover, it would confirm Mr. Allen's observation in regard to the variability of the jay's note—his "unexpected eccentricity" in Kansas—if indeed Mr. Allen's observations needed other confirmation than that afforded by

Ridgway for certain other birds in southern Illinois and by Dr. Elliott Coues. The latter has observed that the note of Nuttall's whip-poor-will differs from that of the eastern whip-poor-will in that the western species "does not cry 'Whip-poor-will,' like" the eastern species, but "drops a syllable, saying 'Whip-poor,' or 'Poor-will,' as the fancy of the hearer may interpret." Moreover, the practice of mocking the hawk is, at present at least, confined, so far as I know, to the individuals of such a limited area—this one town—that with Mr. Ridgway we must believe this peculiarity exhibited by the blue jay to be scarcely the "manifestation of a regional impress."

DR. DANIEL HACK TUKE.

DR. DANIEL HACK TUKE, the distinguished English alienist and editor of the Journal of Mental Science, who died early in March, 1895, was a grandson of William Tuke, the founder of the York Retreat, and one of the earliest English workers in the humane treatment of the insane, and was born in York, April 19, 1827. He was a delicate child, of high spirit, and with a turn for investigating; pertinently to which the story is told of him that he once carried the family cat to the woods and left it there, expecting to find it again some day a wild cat. His father being a member of the Society of Friends, he was sent to their school, and afterward to Bradford to study law. Three months' experience in this occupation showed that he had no taste for the law, and he was allowed to gratify his own inclination and study medicine. He held the post of steward at the York Retreat; entered St. Bartholomew's Hospital, London, in 1849; became a member of the Royal College of Surgeons in 1852; was graduated M. D. at Heidelberg in 1853; visited the asylums of Holland, Germany, and France; and in 1857 published his first book, an account of these visits. He was next appointed



visiting physician to the York Retreat and the York Dispensary; became Lecturer on Psychology at the York School of Medicine; was prevented by an attack of hæmorrhage from converting the old family house in York into a private asylum for ladies; recovered in a year, and settled in Falmouth for fifteen years. Here he took active interest in the library, schools, workingmen's clubs, etc., and did much literary work. He settled for practice in London in 1879, and eventually became a governor of Bethlem Hospital. He had great power of continued intellectual work, and a corresponding indifference to mere physical comforts; and possessed an extraordinary memory for details. His work in the study of lunacy and advocacy of the humane treatment for the insane was known all over the world. He visited most of the asylums in Europe and America, never, says the Lancet, "losing a chance of picking up the threads which connected the present with the past. He knew the city of the simple (Gheel) in Belgium and the secluded valley in Ireland where priest healing had held sway. He was one of the originators of the After-care Association for patients who, having left asylums, were not fit for full work. His holidays were combinations of the study of asylums with (insufficient) complete relaxation." He gave much thought and attention to the study of moral insanity. His earliest established literary work was prepared in collaboration with Dr. Charles Bucknill, and is known as "Bucknill and Tuke on Insanity." He set great value on his book on the Influence of Mind on the Body, which has now been "left behind." He was for eighteen years editor of the Journal of Medical Science; prepared an Index Medicus; and undertook and carried out the Dictionary of Psychological Medicine.

A BODY of the English engaged in the Chitral Expedition suffered severely at the river Panjkora, in consequence of the enemy's launching heavy logs of wood down stream, which destroyed the bridge the men were constructing. One of the enemy who was captured in the subsequent fight described in vivid language how their attempt at a night surprise was frustrated by the magnesium light of a star-shell fired from the English camp. "There were two thousand hillmen who set forth that night to crawl up to the soldiers' camp. We lay for hours in the wet fields, with the rain falling steadily, waiting for our chiefs to give the signal for the great rush. Word came round from chief to chief to be ready, and every man crouched, grasping his weapon, to run forward. But at that very moment a devil's gun boomed forth, and lo! instead of bullets and balls coming out, there burst over us a mighty light, so great that we thought the night had suddenly become day. And we cried aloud to Allah to abate his wrath against us, and when the great light faded we all hurried away, and even our mullahs had no word to say."

TRADES AND FACES.

By Dr. LOUIS ROBINSON.

IT is to be feared that any present attempt on the part of the physiognomist to analyze trade expressions must be somewhat unsatisfactory to the lovers of exact science. Our proved knowledge concerning the laws which govern facial expression is very slight: we are still stumbling among the elements of feature language, and it may seem presumptuous to attempt to criticise the text when the very alphabet is still doubtful.

But as the digger-out of a cryptogram finds it profitable to take a general survey of the script before attacking details, so it may perhaps be found that a somewhat speculative excursion, such as the present, will not be altogether without value in helping on more precise methods of research. At any rate, such a discussion can hardly fail to interest those among the readers of Maga who have observed the remarkable facial likeness often found among people who follow the same calling, without being able to see why a butcher should resemble his trade brethren more than he resembles the other sons of his father who have become bakers of bread or makers of candlesticks.

When we seek to analyze the forces which are continually at work on the human face, the complexity of the problem as to the interpretation of any prevalent trade expression at once becomes apparent. A few examples will bring this fact home to every reader, and will also help us in taking the first step toward classifying the numerous factors which contribute to the result in any single instance.

In a previous article on facial expression,* attention was drawn to the distinctive cast of countenance exhibited by men who have much to do with horses. No great acuteness of observation is necessary to make it clear that, in the various branches of such professions, a corresponding diversity of type is visible.

Regarding Environment as a portrait painter (if we may venture to personify, in classic fashion, the abstractions of the newer philosophers), we find that she has, after boldly laying on a general groundwork of horseyness, touched the faces with different pigments which greatly affect the final result.

If, for example, we place side by side a gentleman's groom and a horse-dealer's groom, both of whom, when seen in a crowd of ordinary mortals, strike us as typically horsey, these supplementary touches are at once brought into prominence. The one

* See Popular Science Monthly, vol. xlv, p. 380.

face reveals something of the superfine genteelness of the flunkey, the other a shifty truculence acquired among the chafferers of Barnet or Ballinasloe. In like manner we may distinguish between the many sections of the great tribe of Jehu. In the expression of the 'bus-driver, still more in that of the driver of a tradesman's or carrier's cart, but most of all in that of the brewer's drayman, the extra coats are so numerous as to obscure the original grounding. In the two former, traffic with humankind, and other circumstances, such as constant exposure to the weather, have entered into competition with the feature-molding power of the horse; in the last, all equine traces have been dissolved clean away by malt liquor. Should a certain popular belief, to the effect that contact with horses has a malign effect upon the character, be borne out by more exact researches in moral pathology, the phenomena observable in the drayman's face might suggest a powerful antidote, and one which would readily be taken by the afflicted—although (as is often the case with new remedial measures) it would, without doubt, be denounced by a considerable section of the public as ten times worse than the disease.

One would have thought that the riders and ringmaster at a circus would exhibit a marked degree of facial horseyness; but, strangely enough, this is not so. The reason seems to be that in a circus the achievement of certain difficult feats to the satisfaction of the audience wholly occupies the minds of the performers, and the horses, large as they loom in the eyes of the public, are regarded by the circus folk as mere "properties."

Now it is plain that, in the cases given, numerous agencies of a widely diverse character are responsible for the total results. Association with horses can only change a man's facial aspect by first influencing his mind, and hence the general common groundwork alluded to is essentially psychic in origin.

On the other hand, certain of the supplementary touches in the cases brought forward seem at first sight to be purely accidental, and to have no mental significance whatever. Hence it might seem that those who study the human face as an index of the mind might safely ignore such physiognomical items as are due, let us say, to exposure, to heat, or cold, or to other purely direct causes. This, however, is only partly true, if it is true at all. Every student of the psychology of expression must be extremely cautious in neglecting any particular trait because it seems due to some accident of environment which has no apparent effect on the central nervous system.

That there is a continual stream of influence passing from the brain to the muscles of expression, which tends to give a permanent cast to the features, has been shown; but it is not so generally recognized that there are also reverse currents from the

organs of expression to the inner nerve centers, and that in many cases these are sufficient (even when induced by agencies which must be called external and fortuitous) to give a bias to the mind. When Mr. Du Maurier depicted a small child forcibly wagging the tail of a big St. Bernard in order to put it in a good humor, most people who laughed at the conceit probably thought that the child's plan was as illogical as that of moving the pointer of a barometer in order to bring about a change in the weather. But it will be seen, when we come to discuss these curious centripetal currents, that this is by no means the case. Indeed, in all probability, some of the mental peculiarities which mark the members of certain professions may be owing to changes which originated primarily in the features.

Leaving this subject for the present, let us pay attention to some of the face-making forces which act from within. In my previous article a good deal was said about the facial muscles, and the nervous mechanism which controls them. It was explained how a constant succession of stimuli to one set of muscles would, in the course of time, give them a predominant influence, and so bring about a general change of expression. Nowhere can such a result be seen better than in the horsey type above alluded to. Speaking generally, the expression of all men of action is attributable to like causes. In such people the chief motive force is the will, which is continually exerting authority over the man himself, or over other men or things. Hence we find that the expression mechanism which is under the control of the will (consisting chiefly of muscles of the striped variety) is mainly responsible for the result.

But a little reflection will show that the salient points of many of the typical faces which we constantly see are under but little obligation to these agents of the will. It is beyond the power of the facial muscles shown in works on anatomy to give a man a shiny nose or a double chin, or to affect the tint and general tone of the integument.

Such changes must be attributed to the influence of the *sympathetic nervous system*, which is practically independent of the will, and which profoundly influences growth and nutrition in all parts of the body. Any one who has looked into a treatise on physiology will have seen diagrams of the sympathetic nervous system, and will have learned that nearly all unconscious organic processes, such as the digestion and assimilation of food, the movements of the heart, the alteration in the caliber of the arteries, and the special functions of innumerable glands, are carried on under its management. He will also have learned that fibers from the sympathetic ganglia frequently join the nerve trunks derived from the brain and spinal cord; and that

this is very markedly so in the case of those cranial nerves which supply the face with common sensation. Probably he will have observed that in the neighborhood of the heart, stomach, and liver, as well as in certain other parts, there are extraordinary aggregations of sympathetic fibers. Each of these dense networks of nerves and ganglia is called a *plexus*, and primarily, no doubt, each *plexus* is busily engaged in superintending the purely organic duties of the viscera in its neighborhood. But this is not its only function. It is a very curious fact that when we try to localize any deeply felt emotion, it seems to appeal to the consciousness from one or other of these very regions. The least analytical mind is aware that we do not love, or hate, or fear, with our heads, but that, in each case, the feeling takes its rise somewhere in the body cavity. Hence the conventional phrases, "warm-hearted," "bowels of compassion," and many others of like nature, which are only approximately correct from an anatomical point of view, since it is demonstrable that the organs named are only affected secondarily, and do not indicate the exact spot where the emotion is felt.

It is not possible to discuss this subject fully on the present occasion; but enough has been said to show that, in their inception as well as in their expression, the feelings which accompany the passions are referable to parts of the sympathetic nervous system.

Now the question might very naturally be asked, What has all this to do with physiognomy? I hope to show, if my readers will follow me in an argument involving a few more technical details, that in these complex functions of the sympathetic nervous system we may find an explanation of certain curious points of facial resemblance among people whose pursuits and mental habits, at first sight, put them as far as the poles asunder.

We will take, as examples, the common facial traits seen in professional musicians, religious devotees, of the priestly class, and sensual "men about town."

To show how the fibers from the sympathetic ganglia affect growth and nutrition in certain localities, let me instance the different results which follow the division of the fifth cranial nerve in two different parts of its course from the brain to the face. If it is cut *after* it has received its accessory fibers from the sympathetic system, a destructive inflammation at once arises in the eye, owing to defective or perverted nutrition; but if the division takes place on the cranial side of the ganglion through which the nerve passes, so as to leave the sympathetic fibers intact, no such consequences follow, although the part supplied by the nerves is entirely cut off from the brain.

Redness or pallor of the skin is the direct result of the influ-

ence of the sympathetic nerves upon the muscular coats of the smaller blood-vessels, and such visible changes are often confined to a small area. When, owing to some wave of emotion, the cheeks flush or turn pale, the same stimulus which effects such an alteration in outward expression *will also disturb the existing conditions of nutrition in the regions affected.* And it appears exceedingly probable that just as the faint currents continually flowing along the motor nerves are to a great extent responsible for the prevailing "muscular" expression of the countenance, so also slight but continuous emotional stimulation of the sympathetic fibers which supply any part of the face may influence its growth in a marked degree in the long run, although at any given moment the vascular consequences may be imperceptible.

Now it is within the knowledge of every one who has turned a curious inward eye upon his feelings that certain emotions which deeply stir the inner man, and which may make us glow or shudder to the finger tips, do not cause any facial changes, except, perhaps, a slight difference in the hue of the brow or cheeks, and a glistening or darkening of the eye. This is often the case when we are under the control of the deeper feelings. We do not laugh when filled with the most exalted joy, or distort our faces when overwhelmed with grief. The fierce emotion which seizes on man and beast alike when the grosser appetites hold full sway often produces many profound changes of an organic nature without provoking any activity in the expression muscles.

Even when certain forms of emotion tend to distort the features if provoked in a natural and direct manner, they fail to react upon the facial muscles when produced artificially, as they may be by a play, a novel, or a strain of music. During the silent perusal of a pathetic story many people confess to a "lump in the throat," but it is very seldom that the corners of the mouth are twitched downward.

These deliberately induced or artificial emotions offer an interesting field to the psychologist. They evidently differ from their elementary prototypes as much as polarized light differs from direct light. They tint what would else be both hideous and prosaic with all the colors of the rainbow, so that we are able to take pleasure in tragedy,

> "And with an eager and suspended soul
> Woo terror, to delight us."

If we survey the faces of a crowd of people at a concert, we find that they offer scarcely a hint of the emotion evoked by the music. The features of the listeners remain as placid as if they were asleep, and as if the inward excitement which thrills them,

and which makes their pulses throb and their flesh "creep," were but the sham excitement of dreamland. As a rule, the same may be said of the ecstatic feelings which accompany devotional exercises. I do not allude to public prayers from the pulpit—where an earthly audience has to be borne in mind—but to the silent communings of private worship, when the soul feels that it has entered the holy of holies, and stands naked before the Eternal Powers.

If it were possible to set apart certain individuals in whom all emotional impulses reacted upon the features *via* the sympathetic, to the exclusion of the motor nerves, we should expect to find among them many strong points of resemblance in facial expression. Although, happily, no such creatures exist among healthy human beings, it is by no means difficult to indicate whole classes of people whose pursuits, or mental habits, give the sympathetic system a preponderating influence.

Professional musicians, priests, and sensualists, all, as a rule, bear distinct certificates on their countenances that they belong to such a category.

But before we are in a position to discuss the special points of resemblance among these very distinct classes, it will be necessary to clear the ground of certain stumbling blocks.

Since the facial changes in question are brought about by means of the machinery of nutrition, it must be taken for granted that this machinery is in good working order in every case, and that it is reasonably well supplied with raw material in the shape of victuals and drink. If one of our subjects should chance to be an ascetic or a dyspeptic, it is plain that all trophic processes, whether direct or indirect, will be so profoundly affected that it would be unfair to compare him with people who live well and have sound stomachs. Again, the possession of an exceptionally alert intellect would vitiate results in any individual, since this tends, as is well known, to develop a distinct type of face. The candidate for sympathetic facial marks must also maintain an aloofness from the turmoil and traffic of the world about him; although it does not much matter whether the wall which shuts him off from his fellows consists of substantial bricks and mortar, or of professional enthusiasm, or of mere selfishness.

It will be well, for the present, to confine our attention to subjects of the male sex who are past their first youth, since women and young people exhibit but few conspicuous traces of emotional influence upon facial nutrition as compared with men of mature age. Probably the reason of this difference is found in the fact that both women and youths are normally more under the sway of the feelings than are men, and therefore special emo-

tional stimuli do not cause any deviation from the type of face which usually characterizes them. If we were to take two individuals, one a trained gymnast and the other a clerk with flabby muscles, and were to make them exercise one arm, so as to develop it to the fullest extent, there can be no doubt that, when this end was attained, the latter would deviate more noticeably from his usual state than the former.

From the fact that women are more governed by their emotions than men, one might be tempted to jump to the conclusion that constant emotional stimulation of the kind we are discussing would tend to produce an effeminate type of face. But, as a matter of fact, this is only true to a very limited extent. It must be remembered (and this is a point upon which I wish to lay special stress) that artificial emotion—such as is evoked by music—has to make use of nervous machinery *belonging primarily to the body rather than to the soul*, and which remains indissolubly connected with certain organic processes common to man and beast.

Now there can be no question that any deep stirring of the emotional side of our nature tends to throw us back upon the bestial substratum derived from our remote ancestors which we generally keep covered up. In a strong gust of passion the "vital spark," which crowns our material being like a nimbus, is extinguished, and the ancient and half-quenched embers of animality beneath are fanned into fierce life. A man, excited or enraged (in common with other mammals of the combative and covetous sex), becomes emphatically a savage male. Hence habitual stimulation of the emotional side of our nature will tend to enhance, rather than to diminish, certain sexual differences in expression.

It is extremely important that we should bear in mind that passion prints on the face are often quite useless in enabling us to form an opinion as to the moral character (as distinct from the moral *tendencies*) of any individual. For the inhibitory centers of the mental apparatus, upon which depend our powers of self-restraint, do not exercise their veto beyond the frontier line which separates the rational from the organic side of human nature. And, let us recollect, it is the latter region which is governed by the sympathetic system, with its complex emotional and trophic functions. Thus, although a man may feel illicit passion, or unrighteous rage, without deviating in act from the path of rectitude, yet his heart, his skin, and other parts under the sympathetic *régime*, will ignore both the moral code and any voluntary decision to obey it.

Not only may the organic part of a man show every sign of guilt when there is no guilt, but only temptation; but it may

even go further in attaching a false and slanderous label to the countenance, owing to the interlocking mechanism of emotion, passion, and nutrition, above alluded to.

Doubtless some of my readers have chanced to contract a black eye in a perfectly innocent and unpugnacious manner. Let us suppose, for the sake of argument, that it resulted from a sharp return across the tennis net. Until the last of the dismal tints fades away, such a one bears about with him one of the most generally accepted proofs of a hasty disposition and of a blackguardly encounter. Yet the victim himself—and each of his friends who will believe his statement—knows that not only is he innocent of a breach of the peace, but that, when he received the ugly mark, he was engaged in one of the most amiable of recreations.

Now in like manner, certain popularly received evidences of a bad moral record may be printed accidentally *from within*. For the molecular impulses welling forth from a disturbed emotional center may chance to flow along channels usually occupied by less innocent currents, and may produce an expression nearly identical with that which accompanies some form of vice. And yet, all the time, the said emotion may be as essentially distinct from the travelers which usually follow the track, as were Bunyan's Pilgrims when they walked the streets of Vanity. In such a case it will be seen that, in spite of outward appearance, not only is there no guilt, but there may be also a complete absence of evil inclination.

To return from what I fear may be regarded by some as a rather arid and metaphysical region, let us take stock of the typical characteristics of the musician, the priest, and the sensualist, who have so oddly foregathered in the interests of science. Physiognomy, it will be seen, like misfortune, makes strange bedfellows.

To get our typical musician, we must, to some extent, follow the example of the society caricaturist. That is, we must generalize, after the fashion of a composite photograph, and then slightly magnify the traits which are found to be common to most members of the class. Probably professional singers approach our ideal most nearly, because the mastery of the *technique* of voice music involves fewer disturbing influences (from our point of view) than does the mastery of any complex external instrument.

The average musician's face shows but little trace of muscular activity, but evidences of trophic changes due to sympathetic disturbance are abundant. The skin, especially beneath the eyes and about the throat, tends to be full and baggy, and is often filled out with local accumulations of fat. As a rule, the eyes

are prominent and dreamy, the cornea is bright and the conjunctiva glistening, but the natural blue-white of the sclerotic has given place to a duller tint. The nose is characterless (as far as acquired qualities are concerned), and differs essentially from the clear-cut nose of the man of active will or intellect. The mouth is the least constant feature, but it generally is characterized by a lax and flabby set of the lips. It is the sensuous mouth belonging to the artistic temperament, with certain specific characters superadded, which result from the same causes as are responsible for the fullness beneath the eye and chin.

Now, why does the mouth, which commonly accompanies the artistic temperament, suggest habits of self-indulgence? It is an essential, with every true artist, that he should follow certain spontaneous impulses. He is born, not made. He can not, like the student or the man of business, hope to excel by toiling against the tide of inclination. In his art he therefore achieves most through a species of self-indulgence; and it is too often characteristic of the artist that this drifting tendency widens and embraces other departments of life. Yet, although it may be confined to artistic matters alone, any habitual yielding to natural impulse will tend to tell its tale on the mouth.

Although the subcutaneous tissues of certain parts of the musician's face are plainly increased in bulk through sympathetic influence, one does not find that the skin itself is much altered in texture. It is, however, usually pallid, and does not exhibit the full-blooded coarseness observable in the other types which we are considering. I am inclined to think that the peculiarities which are generally so obvious in the hair among professional musicians are not altogether dependent upon fashion, but that here again we have evidence of trophic changes which result from mental habits. Almost every fashion of this kind, when carefully analyzed, is found to be based upon some natural physical peculiarity. All who have to do with the treatment of mental disease know how profoundly the growth and vitality of the hair is influenced by emotion; and it seems very probable that local trophic stimulation, similar to that which gives a fullness to the throat, etc., may effect typical changes of this kind also.

Passing on to the priestly class, we find many undoubted signs of special sympathetic influence upon the face. It should be understood, however, that the term "priestly" must be taken in a very broad sense. Any religious devotee with mystical tendencies, who makes much of the emotional and little of the intellectual side of religion, is liable to develop something of the characteristic priestly aspect. It is not unknown among those archenemies of priestcraft, the Quakers, although these good

folk are generally too much in touch with the world to develop it to such an extent as do mystics who live in seclusion, or under the dwarfing shadow of ecclesiastical authority.

In this type of face we find not a few points similar to those already discussed. For some mysterious reason the subcutaneous tissue over the cheek bones and under the jaw gets an undue supply of nourishment. The skin, however, is less flabby and has more color than that of the musician, and in this respect the priest occupies an intermediate position between him and the last of our trio. Naturally, there is more evidence of mental activity in the priestly than in the musical face, and, especially where our reverend subject is conscious of a share in the apostolic legacy, his sense of authority gives a more muscular set to his lips. Habits of self-denial and self-command give him characteristics which make him, as a rule, compare favorably with his physiognomical associates; but when these, and marked intellectual traits, are absent, and no physical bars to nutritive processes intervene, he is capable of reaching an even lower level of ugliness than they.

Probably nowhere can one see the less prepossessing characteristics of the priestly type in so pronounced a form as among the humbler Catholic clergy in Ireland. Here we have most of the conditions (mentioned above) which are required for the full development of sympathetic facial traits. The Irish priest is generally drawn from a healthy and imaginative peasant class, readily given to emotion and superstition, and not overburdened with intelligence. His constitution is sound, his digestion is good, and he is not very rigidly abstemious either by rule or custom. I see no reason to doubt the testimony of impartial critics who declare that, taken as a whole, the Irish priests are the most chaste and devoted body of clerics upon earth. They are undoubtedly of good report, but they can not be classed among the "things that are lovely." Judged from the conventional rather than from the scientific standpoint, the expressions of these good men are indicative of anything but of spiritual purity or of intellectual refinement. In their jaws, lips, and eyes, those traits which are generally considered to be the marks of the grosser animal qualities are so apparent as to force themselves upon the attention of the spectator.

Now why does a clerical congress in the Isle of Saints appear —as far as outward facial aspect is concerned—like a parliament representing the interests of the world, the flesh, and the devil?

People of "the opposite religion," to use a convenient phrase which we owe to Lord Salisbury, have not been backward in suggesting explanations of the phenomena which are not very favorable to the doctrines and practices of the spiritual followers

of St. Peter. And in like manner some of those "painefull and pious" Christians who regard all theatrical and similar amusements as sinful, find support for their views in the stodgy visages of musicians and public singers. In both cases science is on the side of the charity which thinketh no evil. For if the inferences here drawn from what we know as to the physiology of emotion are correct, the facts prove no more than that the ugly priest, or public entertainer, has good assimilative organs, deep feelings, a sluggish mind, and narrow interests. If in feature he tends to resemble certain moral offenders, the fact is owing to a mere unhappy accident, like the black eye of the tennis player aforesaid. Any such resemblances depend upon the fact that man's emotional machinery has not kept pace with civilization, but is still practically in the same state as when it was adapted for the very limited wants of our pristine ancestor, who had no inward feelings unassociated with animal appetite. Our complex modern life has revealed its deficiencies, just as the advent of a missionary among certain primitive races reveals the ludicrous poverty of languages, which can only express the idea of "heavenly bliss" by words meaning "a very full belly."

Into the distinguishing facial traits of the sensualist it is not necessary to enter. In his case the evil expression is honestly come by, and is due to no physiological accident. To any competent reader of facial records it tells its story with a frankness which out-Zolas Zola. What is chiefly of interest about it is the mechanical process by which the inner man is revealed upon the surface. Here, again, we find that the sympathetic nervous system is the agent chiefly responsible; for the changes which have occurred since the face lost its youthful innocence are owing to trophic rather than to muscular causes.

It is worth while noting that here, as in the other tpyes instanced, the exercise of the will and the intellect, or any interference with organic nutritive processes, will mask the facial results of yielding to emotion. Any man of the world will support me when I say that there are not a few grossly sensual men whose expressions do not readily betray them. An ascetic debauchee is an impossible being, but there are not a few instances of men who give free rein to their desires, who nevertheless, from some defect in the assimilative organs, or from the fact that they exercise their wills and minds in other directions, do not develop the bloated countenance and prominent lustful eye which typify the class generally.

In concluding my remarks on the three types we have been discussing, let me say that no abnormally acute powers of observation are required to enable one to distinguish the actual marks of vice from the marks of sensuous emotion which is innocent in

character. But it is evident that the resemblance is quite suggestive enough to confuse the crowd, and to provide mud for the ever-ready hand of the religious controversialist. Let it be remembered, also, that we are not dealing here with any of the deeper results of the complications which arise owing to the diverse functions of the machinery of emotion. Dean Swift, in his ruffianly onslaught on the revivalists of his day, had enough truth on his side to give point to his parable. In *our* religious devotee the physical results of excitement do not break through the barrier set up by the inhibitory centers, and come into the region of conduct.

Having had occasion to make free use of the word "artist," it may be worth while to devote a few words to the class most generally known by that name. In the case of most painters, and all sculptors, another and most important expression factor comes into play. I allude to the effect of unconscious imitation.

This subject was touched upon in my previous article, when an explanation was attempted of the remarkable resemblance which often becomes apparent between persons who live together.

There appears good reason for believing that even an unsubstantial ideal face which is always before the mind's eye will influence the expression muscles in a like manner. Among the majority of artists who paint or model the human figure certain standards of perfection, generally founded upon the old Greek masterpieces, are ever present to the mind—more so, probably, than the face of any human companion. Now when we strive to realize a mental picture of another face, whether it be that of a god or a costermonger, we unconsciously imitate it. Careful observation of a considerable number of artists' faces has convinced me that such involuntary mimicry is a considerable factor in determining that classic cast of visage which is certainly more common among men of this profession than among those of any other. On the other hand, we find that caricaturists and all low comedians of the pencil tend to develop an eccentric expression. Those who have lived long enough to watch the development of certain well-known faces in the artistic world will, I think, agree with me that in most cases the acquired expressions are broadly reflections of those chosen ideals which have been occupying the thoughts and employing the hands of the artists.

Landscape and *genre* painters are of course free from this kind of influence. There is nothing in their work or in their ideals that can be reproduced by the mechanism of the body, and any reaction of the nervous system must be akin to that of ordinary sensuous impressions. These, as we have seen in the case of the musician, do not conduce to personal beauty. It seems prob-

able that Turner might have been a much more presentable man, though possibly less famous, had he devoted himself to figure painting.

Actors' and actresses' faces are of great interest to the physiognomist. An actor's art must of necessity involve the stimulation of both the muscular and trophic factors of expression. Not only has he to emphasize the facial movements which are appropriate to his part, in order that his expression may be plainly seen by the pit and gallery, but he is as a rule obliged to change his rôle frequently, and to assume a succession of characters requiring very different facial renderings. As a result, all his expression muscles are exercised as thoroughly as are the body muscles of an athlete who is undergoing a systematic course in a gymnasium. Hence in a typical actor's face, when seen at rest, no one group of expression muscles outpulls the others, and as a consequence of this state of muscular balance there is about it a peculiar aspect suggestive of a mask. Moreover, this impassive and almost wooden look is enhanced in many cases by an even layer of subcutaneous fat—the result, probably, of emotional stimulation of a constantly varying character.

I am aware that many actors state that they do not consciously experience the emotions which they simulate; but from the very fact that they are able, without taking thought, to adapt their voices, gestures, and expressions to the sentiments they utter, it is clear that the organic (sympathetic) nerves are moved if the conscious ego is not, and, as we have seen, this is all that is required to influence trophic function whether in the face or elsewhere. Miss Ada Rehan, who was kind enough to assist me in clearing up this point, stated that, in rendering any particular expression, she is quite unconscious of any deliberate effort of the will.

One consequence of the full exercise of all the facial muscles, and of the trophic results of varying emotions, is a remarkable interference with the time records which are usually so visible on the human face. In fact, most actors maintain a somewhat boyish aspect until late in life, although the suggestion of callow immaturity is at times rather startlingly contradicted by the expression of the eye. In ladies who adopt the stage as a profession, a true youthful appearance is, as a rule, much better maintained. Until the physiological principles which account for the phenomenon are understood, it must remain a very puzzling fact that an actress's life should be more favorable to the preservation of good looks, and even of girlish freshness, than the life led by women who occupy their natural sphere, and who cultivate (as they think) all physical and moral virtues. A successful actress must work extremely hard, gener-

ally by artificial light, and in a gas-befouled atmosphere. Her hours for work, meals, and sleep are all utterly bad from the hygienic point of view; and not infrequently she makes bad worse by falling into those bohemian habits which are an immemorial tradition of her class. Her secret, apart from the laws regulating the expression and nutrition of the face above stated, consists chiefly of avoidance of monotony and petty worries—those archenemies of feminine good looks and good temper. Her work, if arduous, is generally performed both with earnestness and lightness of heart; and, above all, she gets a sufficiency of bodily exercise of the kind (although not under the conditions) most conducive to health—viz., exercise involving quick and general movements of the muscles, combined with a certain amount of mental excitement.

Any one who considers the preservation of female beauty worthy of serious attention can draw from the facts here stated some general principles, resting on a sound and scientific basis, upon which to found rules for the guidance of the sex. I see no reason why the average British matron should not be physically qualified to play Juliet at fifty if she will observe all the conditions favorable to the preservation of youthful good looks. Indeed, when we bear in mind the many adverse circumstances in a stage career, a lady who goes to bed at half past ten and rises at seven or eight, should be able to give an actress ten years, and beat her easily.

Descending from the realm of Venus to that of Vulcan, let us consider, while we stand among the smoke and sparks of the forge, the problem already alluded to as to the reaction of the expression on the mind. As the smith wields his hammer with an energy which has something fierce and vengeful about it, he automatically contracts his brow into a frown. He does this partly, no doubt, to protect his eyes from the flying flakes of metal; but if you watch the face of the man who holds the iron on the anvil, you will find that although he lowers his eyebrows somewhat as the sledges descend, he does not scowl as do the strikers. In most blacksmiths the constant exercise of the *corrugator supercilii* muscles causes a permanent frown, and gives the face a somewhat hard expression; but whether there is any inward and spiritual state corresponding with this outward and visible sign I am not quite sure. Certainly there is a popular belief that, as a rule, the blacksmith is a serious and downright person, who "looks the whole world in the face," and who does not take chaff kindly; but the popular mind is peculiarly liable to be biased by such obvious arguments as are presented by the smith's lowered brow and huge biceps, and does not stop to weigh their pertinence in deciding questions of character. I remember

being a good deal impressed, when residing in a shipbuilding town, by the intent gaze and bent brows of the riveters and boilersmiths with whom I was brought in contact. One instinctively wondered at first what there was about a harmless hospital surgeon who ministered to them in times of dire trouble, to excite such an air of watchful hostility. I soon found, however, that no hostile sentiments were entertained, but that the frowning, falconlike expression was explained, partly by the "smith's scowl" above mentioned, and partly by the fact that all these men were rendered somewhat deaf by their noisy work, and in consequence had a habit of closely watching the face of any one who conversed with them. Whether their characters in any way corresponded with their acquired expressions I did not discover; there was a grave courtesy in their demeanor while in hospital which was singularly dignified and pleasing, although always slightly suggestive of the politeness of foes during an armistice.

It is easy for any one to satisfy himself by making a few experiments that the act of striking a forceful blow, even at the empty air, tends not only to bring a flush and a frown to the face, but also to awaken an inward glow of emotion which is the raw material of wrath. We all know how certain individuals, when they think it expedient to be angry, "work themselves up" by deliberately assuming a loud, harsh voice, violent gestures, and other choleric symptoms. Here there can be no doubt about centripetal currents which pass inward from the expression organs, and which influence the mind. Nor is it necessary that the will should be called into requisition in order to set such currents in motion, for persons much given to involuntary blushing, and who experience the distressing mental abasement and confusion which accompanies a general dilatation of the arterioles of the face and brain, find that any outward circumstance, such as the heat of a room, which tends to redden the face, also renders them liable to the psychic accompaniments of a blush. Moreover, it is well known that the assumption of an expression of dejection contributes to lowness of spirits, and that we find it easier to be brave with our chins up and our shoulders squared than when we cringe and look at our boots.

In religious services involving an elaborate ritual, posturing is made use of in all parts of the world as a remedy for mental inertia. Doubtless the general prevalence of the practice is a strong testimony in its usefulness, although such strategy, based upon the innate tendency of the mind to conform to the body, appears, from one point of view, a trifle undignified, in warfare where the spirit is endeavoring to assert its eternal supremacy over the flesh.

Moreover, occasionally, the laws upon which these and like

ceremonials are founded seem to be reversed. Professional merry-men are proverbially grave and melancholy in private life, while undertakers, according to Oliver Wendell Holmes, are cheery beyond their fellows. The assumption, therefore, of devotional attitudes, and of a pious countenance, in the hope that the soul may follow suit, may not be so safe as has been generally supposed.

Even if space permitted, it would be impossible on the present occasion to analyze each of the many distinct trade expressions which must be familiar to all dwellers in towns. In the first place, our knowledge of the inner lives of most persons outside our own class or social circle is quite insufficient to justify us in theorizing concerning the forces which may have been instrumental in making them, facially, what they are. Until some enthusiastic naturalist will apply the methods of Lubbock and Huber to his fellow-men, we must be content to remain in comparative ignorance. But if the general principles which I have ventured to put forward in this paper are to be trusted, any new fact concerning the habits of any section of the great human swarm may at once be made available by those who are endeavoring to place physiognomy on a sound basis.—*Blackwood's Magazine.*

NATURAL RAIN-MAKERS.

By ALEXANDER McADIE.

THE efficiency of the clouds in lifting water will be brought home to us if we consider the rainfall over a garden fifty feet wide and one hundred feet in length. If one hundredth of an inch of rain occurs, about twenty-five gallons or two hundred and fifty pounds of water will have fallen. One inch of rain over the garden would mean twenty-five thousand pounds of water.

A rainfall of forty-five inches in a year is not an unusually large rainfall. New York city has a mean annual rainfall of 45·2 inches, the observations covering a period of twenty-two years. If this rain of a year fell in equal amounts each day, we would have for every acre of surface two thousand eight hundred gallons of water, or in avoirdupois nearly nine thousand tons of water to the square mile. Tipping Manhattan Island each evening and draining it would give two hundred thousand tons of water. In a year over seventy million tons of water are dropped on the roofs, sheds, and pavements of Manhattan Island.

It requires a powerful pump to lift water in such quantities and store it in reservoirs thousands of feet above us. And these reservoirs are remarkable; for they have no walls of rigid ma-

sonry, and they course across the sky at higher speed than man can travel. A locomotive can travel a mile in thirty-seven seconds, a fast yacht in about twice that time, and a swift torpedo boat in one hundred and ten seconds. The upper clouds move with an average velocity of a mile in thirty-six seconds, and have been observed moving as rapidly as a mile in eighteen seconds. Equally remarkable are the plastic walls of these aërial reservoirs. No courses of heavy stone and mortar are to be found; but in their stead drops of water so minute that a thousand of them side by side would not extend farther than one inch. If the temperature

ALTO-CUMULUS.

was low during the building of the cloud, the water drops are changed into ice spicules and snowflakes.

From such reservoirs the rain falls as a rule harmlessly. A collapse, which rarely occurs, is known as a cloud-burst. Then, the deluge destroys life and property, sweeping all before it.

If we were able to control the valves and vents of this tremendous pump-reservoir, we could cause rain at will and shut off the downpour at pleasure. But hardly yet may we hope to master the rain. Rain-makers of our time bang and thrash the air, hoping to cause rain by concussion. They may well be compared to impatient children hammering on reservoir walls in a vain endeavor to make the water flow. Rain-control is a scientific possibility. Successful rain engineers will come in time, we

venture to predict, from the ranks of those who study and clearly understand the physical processes of cloud formation.

Cloudland, for a realm so near us and so closely associated with our welfare, has been sadly slighted by man's genius. The ancients were surprisingly stupid in their views and discussions of air, wind, and clouds. The wisdom of Aristotle, filtered through the mind of his favorite pupil Theophrastus of Eresus, does not show to advantage in these subjects. Nor have the moderns achieved much that is worthy of detailed mention until a comparatively recent period.

Our cloud names date from the beginning of the century. At a meeting of the Askesian Society in 1802, a young chemist of Tottenham read an essay in which he proposed the terms stratus or sheet, cumulus or heap, and cirrus or feather for cloud names. One attempt at cloud classification had been made previously, but Howard's scheme was so superior that it at once received recognition. The essay was reprinted, translated, and officially adopted in all the great countries of the world. While Howard's name is known to all meteorologists, little has been handed down concerning the man himself. He is quaintly described on the title-page of his three-volumed Climate of London, as a Citizen of London, Honorary Citizen of Magdeburg, and Honorary Associate of the Art Societies of Hamburg and Leipsic. No less a person than Goethe was among those who were charmed by Luke Howard's work. A friendship sprang up, a long correspondence was carried on, and the poet sings of Howard as one worthy of all honor.

Within the past few years the leading countries of the world through their representatives on the International Meteorological Committee have decided to depose the Howardian nomenclature. The proposal was made four years ago at the Munich Conference, and at Upsala last year a new classification was formally approved. Some of the more prominent sponsors for the new system are Hildebrandsson, Köppen, Neumayer, and Rotch. Modern meteorology demands more than a record of the appearance of the cloud. It seeks the meaning of each formation. The cloud is primarily valuable not on account of its beauty but because it makes manifest atmospheric motions and conditions not otherwise noticeable. A striking illustration of the use which modern meteorology makes of the clouds is found in the storm of August 26 to 29, 1893. This is the storm more familiarly known as the Sea Islands storm, in which eleven hundred lives were lost. At a critical moment the telegraph lines were blown down and all reports were missing south of Savannah. It is said that the storm center was accurately located by the forecasting officials by means of the clouds at distant stations.

Great progress has been made in the past five years in our knowledge of clouds. Two masters in physical science, von Helmholtz and Hertz, were brilliant cloud investigators. The former explained the formation of cloud billows; the latter devised a graphic method of following the adiabatic changes in moist air. The number of tiny solid particles in a cloud can even be counted. John Aitkin, of Edinburgh, has constructed a dust-counter delicate enough to do this. The dust nuclei in the smoky air of London, on the quiet shores of the Mediterranean, on Alpine peaks, or in the pure mists of the Scotch Highlands can be counted and

FRACTO-NIMBUS. Advance Clouds of Thunderstorm.

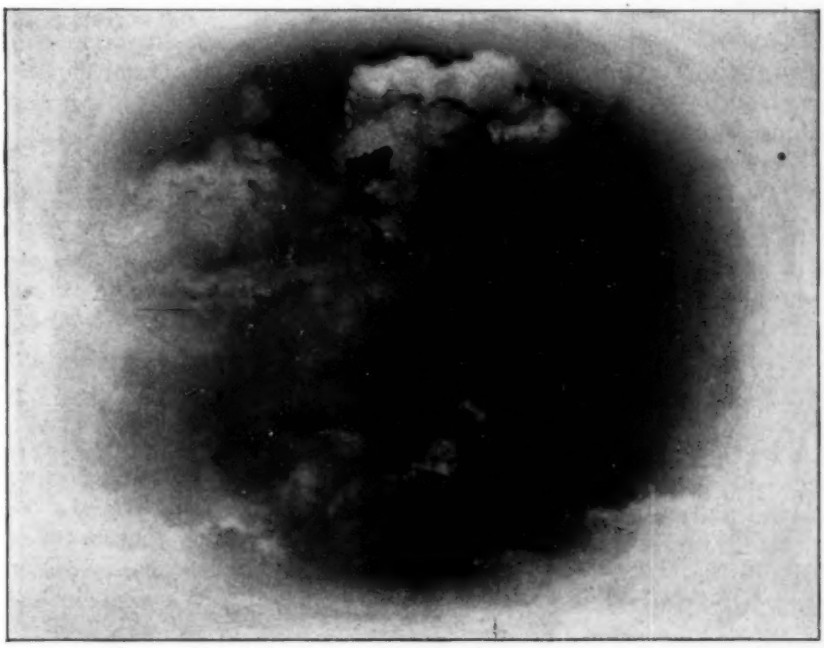
their influence in the making of rain properly appreciated. Both in Europe and the United States meteorologists are studying clouds. At Berlin, Storlein, Upsala, and Blue Hill observers are daily determining cloud heights and velocities, and in the coming year forces will be massed and something akin to a systematic survey of cloudland attempted.

Poet, painter, and all of us have felt the keen delight of following the cloud transitions of a summer sky. All men in all lands are nephelolaters or cloud admirers—for the cloudscape gives all that the most varied landscape can offer. A generous sky knows no difference between the sons of earth, and spreads everywhere scenes of wondrous grace and color. Even the most

commonplace cloud formation—fog—which on earth is often aggravating and trying to health and temper, becomes beautiful as soon as it leaves the earth.

A fog may be defined as a cloud viewed from within, and is therefore the first distinct cloud type. The next low type is the stratus or "raised fog," less than one thousand metres high. And here it may be noticed that in summer the earth pushes her cloud mantle away from her and draws it closer to her in winter. In other words, clouds are lower in winter than in summer. The highest cloud is the cirrus, with a mean elevation of nine thousand metres. The cirrus is a fine, featherlike cloud, and its neighbor, cirro-stratus, something like it, only more diffuse and lower. When a veil of cirro-stratus is drawn before the sun or moon, large halos forty-four and eighty degrees in diameter, with faint red on the inside or nearest the sun, and blue on the outside, appear. These are caused by the refraction of light by ice crystals. A lower cloud, alto-stratus, without causing halos may cause coronæ or smaller circles of prismatic colors, about one fourth the diameter of halos. In coronæ the red is on the outside. The Brockenspecter is a particular kind of coronal cloud shadow. Midway between high and low clouds are the cirro-cumuli and alto-cumuli. These give perhaps the most beautiful of all cloud effects. The fairest meadows of earth seldom show such flocks grazing so leisurely and scattered so harmoniously. Cirro-cumuli are small, white, fleecy clouds, often arranged in rows, while the alto-cumuli are denser, larger, and less regular. Both types are like tranquil fleets upon a serene sea. "Their very motion is rest," as John Wilson said of them long ago. Trailing in lustrous glory before the midnight moon, they turn into silver bars and "streak the darkness radiantly." Of the low clouds, the strato-cumuli and nimbi are most common: the former, large rolls of dark cloud, often covering the whole sky and of somewhat dreary aspect; the latter, nondescripts without definite form and with little gradation in color. The sky effects of both are as a rule somber and depressing, though there are times, especially if the sun be close to the horizon, when the nimbus gives the golden rain of Greek mythology, a downpour inexpressibly beautiful. The cumuli and cumulo-nimbi are the largest clouds in cloudland. The familiar "castles in air" are the turreted cumuli, thick clouds with domes and summits. The cumulo-nimbus, or towering thunder cloud, rises mountain high, and has peaks of snowy whiteness with a flat and frowning base. Its monstrous size can be better appreciated if we imagine Mont Blanc (14,134 feet high) lifted into the air and set down on top of Mount Washington (6,279 feet). This would make a medium-sized cumulo-nimbus. The thunder cloud is noteworthy in another respect,

namely, that the water in it may be cooled below the freezing point and yet not frozen. A snowflake or ice crystal falling into it may suffice to start a sudden congelation, just as we may see ice needles dart in all directions when the chilled surface of a still pond is disturbed. We liken this monstrous cloud to a huge gun loaded and quiet, but with a trigger so delicately set that a falling snowflake would discharge it. The sudden puffs, gusts, and elongations of the thunder cloud may have their origin in this way. Again, there is every reason for believing that electricity plays an important part in the enlargement and subsequent history of this cloud. We have ourselves measured with sensitive quadrant electrometers the pull in volts experienced by the air between one of these clouds and the ground. The approach of the cloud can be foretold *without seeing it* and the sky mapped out roughly by the changes in the electrical potential caused by the passage of the cloud.



CUMULO-NIMBUS.

From what precedes it will be readily understood that cloud motion is not always a true exponent of air motion. Meteorologists know that it is not safe to obtain the motion of the air currents from the motion of the clouds, for the latter may move faster or more slowly, or even apparently stand still in the wind, as in the "table-cloth" cloud on Table Mountain at the Cape of

Good Hope. In reality the cloud is changing rapidly, forming and dissolving at one and the same time.

In forecasting weather, clouds have, as we all know, special significance. They are the true robes and garments of earth. The poet sings of hills clad in verdure, the mantle of tender green that the Earth puts on in the spring, and the splendid hues of her autumnal dress; but the garment which protects old Earth the year round from extreme temperatures is the cloud layer. Where there is little cloudiness the range of temperature is large, and where there is much cloudiness the temperature is very even.

So, while the clouds delight us, they are also active for our welfare. In never-ending procession they move—ragged ranks of fracto-nimbi jostled by frowning cumuli, tatterdemalion scud leading an army of mighty nimbi, the baleful funnel cloud, hovering and ill-omened, rolling strato-cumuli that lie far out on the flank; thus they pass, while in the calm above appear the cirri daihty and lacelike, or curling wisps of laughing cirro-stratus.

STUDIES OF CHILDHOOD.

X.—MATERIAL OF MORALITY.

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(*a*) PRIMITIVE EGOISM AND ALTRUISM.

PERHAPS there has been more hasty theorizing about the child's moral characteristics than about any other of his attributes. The very fact that diametrically opposed views have been put forward is suggestive of this haste. By certain theologians and others, infancy has been painted in the blackest of moral colors. According to M. Compayré, it is a bachelor, La Bruyère, and a bishop, Dupanloup, who have said the worst things of children; and the parent or teacher who wants to see how bad this worst is may consult M. Compayré's account.* On the other hand, Rousseau and those who think with him have invested the child with moral purity. According to Rousseau, the child comes from the Creator's hand a perfect bit of workmanship, which blundering man at once begins to mar. Children's freedom from human vices has been a common theme of the poet: their innocence was likened by M. About to the spotless snow of the Jungfrau. Others, as Wordsworth, have gone further and attributed to the child positive moral excellences, glimpses of a higher mo-

* L'Evolution intell. et mor. de l'enfant, chap xiv, ii.

rality than ours, divine intuitions brought from a loftier prenatal existence.

Such opposite views of the moral status and worth of a child must spring not out of careful observation, but out of prepossession, and the magnifying of the accidents of individual experience. A theologian who is concerned to maintain the doctrine of natural depravity, or a bachelor who happens to have known children chiefly in the character of little tormentors, may be expected to paint childhood with black pigments. On the other hand, the poet attracted by the charm of infancy may easily be led to idealize its moral aspects.

The first thing that strikes one in all such attempts to fix the moral worth of the child is that they are judging of things by wrong standards. The infant, though it has a nature capable of becoming moral or immoral, is not as yet a moral being; and there is a certain impertinence in trying to force it under our categories of good and bad, pure and corrupt.

If, then, we would know what the child's "moral" nature is like, we must be careful to distinguish. By "moral" we must understand that part of its nature, feelings, and impulses which have for us a moral significance; whether as furnishing raw material out of which education may develop virtuous dispositions, or, contrariwise, as constituting forces adverse to this development. It may be well to call the former tendencies favorable to virtue, pro-moral, the latter unfavorable tendencies, contra-moral. Our inquiry, then, must be: In what respects and to what extent does the child show itself by nature apart from all that is meant by education, pro-moral or contra-moral—that is, well or ill fitted to become a member of a good or virtuous community, and to exercise what we know as moral functions?

Our especial object here will be, if possible, to get at natural dispositions, to examine the child in his primitive nakedness, looking out for those instinctive tendencies which, according to modern science, are hardly less clearly marked in a child than in a puppy or a chick.

Now, there is clearly a difficulty here. How, it may be asked, can we expect to find in a child any traits having a moral significance which have not been developed by social influences and education? In the case of pro-moral dispositions more particularly, as kindness or truthfuluess, we can not expect to get rid of that molding effect of the combined personal influence and instruction of the mother which is of the essence of all moral training. And even with regard to contra-moral traits, as rudeness or lying, it is evident that example is frequently a co-operating influence.

The difficulty is, no doubt, a real one, and can not be wholly

got rid of. We can not completely eliminate the influence of the common life in which the good and bad disposition alike may be said to grow up. Yet we may distinguish. Thus we may look out for the earliest spontaneous, and what we may call original, manifestations of such dispositions as affection and truthfulness, so as to eliminate the *direct* action of instruction and example, and thus reduce the influence of the social medium on the child to a minimum. Similarly, in the case of brutal and other unlovely propensities, we may, by taking pains, get rid of the influence of bad example.

Let us see, then, how far the indictment of the child is a just one. Do children tend spontaneously to manifest the germs of vicious dispositions, and, if so, to what extent? Here, as I have suggested, we must be particularly careful not to read wrong interpretations into what we see. It will not do, for example, to say that children are born thieves because they show themselves at first charmingly indifferent to the distinction of *meum* and *tuum*, and are inclined to help themselves to other children's toys, and so forth. To repeat, what we have to inquire is whether children by their instinctive inclinations are contra-moral—that is, predisposed to what, if persevered in with reflection, we call immorality or vice.

Here we can not do better than touch on that group of feelings and dispositions which can be best marked off as antisocial, since they tend to the injury of others, such as anger, envy, and cruelty.

The most distant acquaintance with the first years of human life tells us that young children have much in common with the lower animals. Their characteristic passions and impulses are centered in self and the satisfaction of its wants. What is better marked, for example, than the boundless greed of the child, his keen desire to appropriate and enjoy whatever presents itself, and to resent others' participation in such enjoyment? For some time after its birth the child is little more than an incarnation of appetite which knows no restraint, and only yields to the undermining force of satiety.

The child's entrance into social life through a growing consciousness of the existence of others is marked by much fierce opposition to their wishes. His greed, which at the outset was but the expression of a vigorous nutritive instinct, now takes on more of a contra-moral aspect. The removal of the bottle by another before full satisfaction has been attained is, as we know, the occasion for one of the most impressive utterances of the baby's "will to live," and of its resentment of all human checks to its native impulses. In this outburst we have the first rude germ of that defiance of control and of authority of which I shall have to say more by and by

In another way too the expansion of the infant's consciousness through the recognition of others widens the terrane of greedy impulse. For envy commonly has its rise in the perception of another child's consumption of appetite's dainties.

Here, it is evident, we are still at the level of the animal. A dog is passionately greedy, like the child, will fiercely resent any interference with the satisfaction of its appetite, and will be envious of another and more fortunately placed animal.

Much the same concern for self and opposition to others' having what the child himself desires shows itself in the matter of toys and other possessions of interest. A child is apt not only to make free with another child's toys, but to show the strongest objection to any imitation of this freedom, often displaying a dog-in-the-manger spirit by refusing to lend what he himself does not want. Not only so, he will be apt to resent another child's having toys of his own. The envy of other children's possessions by a child is apt to be impressive by reason not only of its passionate intensity, but of its far-reaching extent.

As the social interests come into play so far as to make caresses and other signs of affection sources of pleasure to the child, the field for envy and its "green-eyed" offspring, jealousy, is still more enlarged. As is well known, an infant will greatly resent the mother's taking another child into her arms.

Here, again, we are at the level of the lower animals. They, too, as our dogs and cats show us, can be envious not only in the matter of eatables, but in that of human caressings, and even of possessions—witness the behavior of two dogs when a stick is thrown into the water.

Full illustrations of these traits of the first years of childhood are not needed. We all know them. M. Perez and others have culled a sufficient collection of examples.*

Out of all this unrestrained pushing of appetite and desire whereby the child comes into rude collision with others' wants, wishes, and purposes there issue the well-known passionateness, the angry outburst, and the quarrelsomeness of the child. These fits of angry passion or temper are among the most curious manifestations of childhood, and deserve to be studied with much greater care than they have yet received.

The outburst of rage as the imperious little will feels itself suddenly pulled up has in spite of all its comicality something impressive. Hitting out right and left, throwing things down on the floor, breaking them, howling, and wild, agitated movement of the arms and whole body—these are the outward vents which the gust of fury is wont to take. Anything will do as object of

* See, for example, The First Three Years of Childhood, p. 66 ff.

attack. A child of four, on being crossed, would bang his chair and then proceed to vent his displeasure on his unoffending toy lion, banging him, jumping on him, and threatening him with the loss of his dinner. Hitting is in some cases improved upon by biting. The boy C—— was for some time vigorously mordant in his angry fits. Another little boy would under similar circumstances bite the carpet.

Here we have expressive movements which are plainly brutal, which assimilate the aspect of an angry child to that of an angry savage and angry animal. The whole outward attitude is one of fierce, ruthless assault. The insane, I am told, manifest a like wildness of attack in fits of anger, smashing windows, etc., and striking anybody who happens to be at hand.

Yet these are not all the manifestations. Childish anger has its wretched aspect. There is keen suffering in these early experiences of thwarted will and purpose. A little boy rather more than a year old used, when crossed, to throw himself on the floor and bang the back of his head; and his brother, when fourteen months old, would similarly throw himself on the floor and bang the back of his head, biting the carpet as before mentioned. This act of throwing one's self on the floor, which is common during this early period, and is apparently quite instinctive, is the expression of the utter *dejection* of misery. C——'s attitude when crossed, gathered into a heap on the floor, was eloquent of this infantile despair. Such suffering is the immediate outcome of thwarted purpose, and must be distinguished from the moral feeling of shame which often accompanies it.

Such stormy outbursts vary, no doubt, from child to child. Thus, C——'s sister in her angry moments did not bite or roll on the floor, but would dance about and stamp. Some children show little if anything of this savage furiousness. Among those that do show it, it is often a temporary phenomenon only.

This anger, it is to be noted, is due to mere check of will by will, and would show itself to some extent even if there were no intervention of authority. Thus a child will show himself angry, resentful, and despairingly miserable if another child gets effective hold of something which he wants to have. Yet it is undoubtedly true, as we shall see, that these little storms are most frequently called up by the imposition of authority, and are a manifestation of what we call a defiant attitude.

This slight examination may suffice to show that with the child self—its appetites, its satisfactions—is the center of its existence, the pivot on which its action turns. I do not forget the real and striking differences here, the specially brutal form of boys' anger as compared with that of girls, the partial atrophy of some of these impulses—e. g., jealousy—in the more gentle and affectionate type

of child. Yet there seems to me little doubt that these are common and among the most pronounced characters of the first years.

Evolution will, no doubt, help us to understand much of this. If the order of development of the child follows and summarizes that of the race, we should expect the child to show a germ at least of the passionateness, the quarrelsomeness of the brute and of the savage before he shows the moral qualities distinctive of civilized man. That he often shows so close a resemblance to the savage and to the brute suggests how little ages of civilized life, with its suppression of these furious impulses, have done to tone down the ancient and carefully transmitted instincts. The child at birth and for a long while after may then be said to be the representative of wild, untamed Nature, which it is for education to subdue and fashion into something softer and gentler.

At the same time the child is more than this. In this first clash of his will with another's he knows more than the brute's sensual fury. He suffers consciously, he realizes himself in his antagonism to a world outside him. It is probable, as I have pointed out before, that even a physical check bringing pain, as when the child runs his head against a wall, may develop this consciousness of self in its antagonism to a not-self. This consciousness reaches a higher phase when the opposing force is distinctly apprehended as another will. Self-feeling, a germ of the feeling of "my worth," enters into this early passionateness and differentiates it from a mere animal rage. The absolute prostration of infantile anger seems to be the expression of this keen consciousness of the self of its rebuff and injury.

While, then, these outbursts of savage instinct in children are, no doubt, ugly and in their direction contra-moral, they must not hastily be pronounced wholly bad and wicked. To call them wicked in the full sense of that term is indeed to forget that they are the swift reactions of instinct which have in them nothing of reflection or of deliberation. The angry child venting his spite in some wild act of violence is a long, long way from a man who knowingly and with the consent of his will retaliates and hates. The very fleeting character of the outbreak, the rapid subsidence of passion, and transition to another mood show that there is here no real *malice prepense*. These instincts will, no doubt, if they are not tamed, develop later into truly wicked dispositions; yet it is by no means a small matter to recognize that they do not amount to full moral depravity.

On the other hand, we have seen that we do not render complete justice to these early manifestations of angry passion if we class them with those of the brute. The child in these first years, though not yet human in the sense of having rational insight into his wrongdoing, is human in the sense of suffering through con-

sciousness of an injured self. This reflective element is not yet moral; the sense of injury may turn by and by into lasting hatred. Yet it holds within itself possibilities of something higher. But of this more when we come to envisage the child in his relation to authority.

The same predominance of self, the same kinship with the unsocial brute which shows itself in these germinal animosities, is said to reappear in the insensibility or unfeelingness of children. The commonest charge against children from those who are not on intimate terms with them, and sometimes, alas! from those who are, is that they are heartless and cruel.

That children often appear to the adult as unfeeling as a stone is, I suppose, incontestable. The troubles which harass and oppress the mother leave her small companion quite unconcerned. He either goes on playing with undisturbed cheerfulness, or he betrays a momentary curiosity about some irrelevant circumstances connected with the affliction which is worse than the absorption in play through its tantalizing want of any genuine feeling. Brothers and sisters may be ill; but if the vigorous little player is affected at all, it is only through loss of companions, if this is not more than made up for by certain advantages of the solitary situation. If the mother is ill, the situation is interesting merely as supplying him with new treats. A little boy of four, after spending half an hour in his mother's sick-room, coolly informed his nurse: "I have had a very nice time; mamma's ill!" The order of the two statements is significant of the child's mental attitude toward others' sufferings. If his faithful nurse has her face bandaged, his interest in her torments does not go beyond a remark on the "funniness" of her new appearance.

When it comes to the bigger human troubles this want of fellow-feeling is still more remarkable. Nothing is more shocking to the adult observer of children than their coldness and stolidity in presence of death. While a whole house is stricken with grief at the loss of a beloved inmate the child preserves his serenity, being affected at most by a feeling of awe before a great mystery. Even the sight of the dead body does not always excite grief. Mrs. Burnett, in her interesting reminiscences of childhood, has an excellent account of the feelings of a sensitive and refined child when first brought face to face with death. In one case she was taken with fearsome longing to touch the dead body so as to know what "as cold as death" meant; in another, that of a pretty girl of three with golden-brown eyes and neat, small brown curls, she was impressed by the loveliness of the whole scene, the nursery bedroom being hung with white and adorned with white flowers. In neither case was she sorry, and could not

cry, though she had imagined beforehand that she would. Even in this case, then, where so much feeling was called forth, commiseration for the dead companion seemed to have been almost wholly wanting.

No one, I think, will doubt that, judged by our standards, children are often profoundly and shockingly callous. But the question arises here, too, whether we are right in applying our grown-up standards. It is one thing to be indifferent with full knowledge of suffering, another to be indifferent in the sense in which a cat might be said to be indifferent at the spectacle of your falling or burning your finger. We are apt to assume that children know our sufferings instinctively, or at least that they can always enter into them when they are openly expressed. But this assumption is highly unreasonable. A large part of the manifestation of human suffering is unintelligible to a little child. He is not oppressed by our anxieties, our griefs, because these are to a large extent beyond his sympathetic comprehension.

We must remember, too, that there are moods and attitudes of mind favorable and unfavorable to sympathy. None of us are uniformly and consistently compassionate. It is wonderful how insensible really kind-hearted people can show themselves on occasion, as, for example, toward the afflictions of those whose previous good fortune they have envied. Children are the subject of moods which are exclusive of sympathy. They are impelled by their superabundant nervous energy to wild, romping activity; they are passionately absorbed in their play; they are intensely curious about the many new things they see and hear of. These dominant impulses issue in mental attitudes which are indifferent to the spectacle of others' troubles.

Again, where an appeal to serious attention is given, a child is apt to see something besides the sadness. The little girl already spoken of saw the prettiness of the death-room rather than its mournfulness. A teacher once told her class of the death of a classmate. There was, of course, a strange stillness, which one little girl presently broke with a loud laugh. The child is said to have been by no means unemotional, the laugh not a "nervous" one. The odd situation—the sudden hush of a class—had affected childish risibilities more than the distressing announcement.

One other remark by way of saving clause here. It is by no means true that children are always unaffected by the sad and sorrowful things in life. The first acquaintance with death, as we know from a number of published reminiscences, has sometimes shaken a child's whole being with an infinite nameless sense of woe. But of this more, presently, after we have heard the rest of the indictment.

Children, says the misopædist, are not only unfeeling when

we look for sympathy and kindness; they are positively unkind, their unkindness amounting to cruelty. What we mean by the brute in the child is emphatically this cruelty. By cruelty is here understood cold-blooded infliction of pain. "Cet âge," wrote La Fontaine of childhood, "est sans pitié." The idea that children, especially boys, are cruel in this sense is, I think, a common one.

This cruelty will now and again show itself in relation to other children. One of the trying situations of early life is to find one's self supplanted by the arrival of a new baby. Children, I have reason to think, are in such circumstances capable of coming shockingly near to a feeling of hatred. I have heard of one little girl who was taken with so violent an antipathy to a baby which she considered outrageously ugly as to make futile attempts to smash its head, much as she would, no doubt, have tried to destroy a doll which had become unsightly to her. The baby, I may as well add, was not really hurt by this shocking precocity of infanticidal impulse—perhaps the smashing was more than half a "pretense"—and the little girl grew up to be a kind-hearted woman.

Such cruel-looking handling of smaller infants is probably rare. More common is the exhibition of the signs of cruelty in the child's dealings with animals. It is of this, indeed, that we mostly think when we speak of a child's cruelty. Young children are not, I think, often charged, even by the harshest of their accusers, deliberately with inflicting pain on their human companions.

At first nothing seems clearer than the evidence of malicious intention in a child's treatment of animals. Look, for example, at a little girl trying to get the cat from some hiding place. She grabs at its tail, receives formidable scratches, yet perseveres with something of a soldier's indifference to her own pains. Do we not here see evidences of a determination to plague, and of a delight in plaguing? Or watch a child chasing a fly on the window pane, and note the hard, doglike pertinacity with which he follows it up and at length pins and crushes it with his fingers.

The question of the innermost nature of human cruelty is too difficult a one to be discussed here. I will only say that, whatever the cruelty of adults may be, children's so-called cruelty toward animals is very far from being a pure delight in the sight of suffering. The torments to which a child will subject a long-suffering cat are, I suspect, due not to a clear intention to inflict pain, but to the child's impulse to hold, possess, and completely dominate the pet animal. It is a manifestation of that odd mixture of sociability and love of power which makes up a child's attachment to the lower animals.

The case of destructive cruelty is somewhat different. Let me give a well-observed instance. A little boy of two years and two months, "after nearly killing a fly on the window pane, seemed surprised and disturbed, looking round for an explanation, then gave it himself: 'Mr. Fy dom (gone) to by by'; but he would not touch it or another fly again—a doubt evidently remained, and he continued uneasy about it." Here we have, I think, the instinctive attitude of a child toward the outcome of its destructive impulse. And this destructive impulse, which as we know becomes more clearly destructive when experience has taught what result follows, is not necessarily cruel in the sense of including an idea of the animal's suffering. Animal movement, especially that of tiny things, has something exciting and provoking about it. The child's own activity, and the love of power which is bound up with it, impel him to arrest the movement. This is the meaning, I suspect, of the fascination of the fly on the window pane, and other small capturable creatures, as later on of birds. The cat's prolonged chase of the mouse, into which something of a dramatic make-believe enters, owes its zest to a like delight in the realization of the captor's power.

Along with this love of power there goes often something of a child's fierce, untamable curiosity. A boy of four, finding that his mother was shocked at hearing him express a wish to see a pigeon which a dog had just killed, remarked: "Is it rude to look at a dead pigeon? I want to see where its blood is." I am disposed to think that the crushing of flies and moths and the pulling of worms to pieces, and so forth, are prompted by this curiosity. The child wants to see where the blood is, what the bones are like, how the wings are fastened in, and so forth.

A like combination of love of power and of curiosity seems to underlie other directions of childish destructiveness, as the breaking of toys and the pulling of flowers to pieces. In certain cases, as in C——'s destruction of a whole garden of peonies, the love of power or effect overtops and outlives the curiosity, becoming a sort of savage greed.*

I think, then, that we may give the little child the benefit of the doubt, and not assign its rough handling of sentient things to a wish to inflict pain, or even to an indifference to pain of which he is clearly aware. Wanton activity, the curiosity of the experimenter, and delight in realizing one's power and producing an effect, seem sufficient to explain most of the alleged cruelty of the

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* Ruskin tells us that when a child he pulled flowers to pieces "in no morbid curiosity, but in admiring wonder" (Præterita, 88). Goethe gives an amusing account of his wholesale throwing of crockery out of the window, inspired by the delight of watching the droll way in which it was smashed on the pavement.

first years. That later on cruelty becomes possible, that the school bully may find his satisfaction in tormenting the "little kids," this is but too certain. Yet even schoolboys with clearest example to guide them are by no means always bullies.

We have now looked at one of the dark sides of the child and have found that, though it is unpleasant, it is not so hideous as it has been painted. Children are, no doubt, apt to be passionate, ferocious in their anger, and sadly wanting in consideration for others; yet it is consolatory to reflect that their savageness is not quite that of brutes, and that their selfishness and cruelty are a long way removed from a deliberate and calculating egoism.

It now remains to point out that there is another and counterbalancing side. If a child has his outbursts of temper he has also his fits of tenderness. If he is now dead to others' sufferings, he is at another time taken with a most amiable, childish concern for their happiness. In order to be just to the child we must recognize both sides.

It must not be forgotten here that children are instinctively attachable and sociable, in so far as they show in the first weeks that they get used to and dependent on the human presence, and are miserable when this is taken from them. The stopping of a child's crying at night on hearing the familiar voice of its mother or nurse shows this.

In this instinct of companionship there is involved a vague inarticulate sympathy. Just as the attached dog may be said to have in a vague way a feeling of oneness with its master, so the child. The intenser realization of this oneness comes in the case of the dog and of the child alike after separation. The wild, caressing leaps of the quadruped are matched by the warm embracings of the little biped. Only that here, too, we see in the child traces of a deeper human consciousness. A girl of thirteen months was separated from her mother for six weeks. On the mother's return she was speechless, and for some time could not bear to leave her mother for a minute.

This sense of joining on one's existence to another's is not full imaginative sympathy—that is, a warm realizing representation of another's feelings—but it is a kind of sympathy, after all, and may grow into something better. This we may see in the return of the childish heart to its resting place after the estrangement introduced by "naughtiness." The relenting after passion, the reconciliation after punishment, are these not the experiences which help to raise the dumb-animal sympathy of the first months into a true human sense of fellowship? But this part of the development of sympathy belongs to another chapter.

Sympathy, it has been said, is a kind of imitation, and this is strikingly illustrated in its early forms. A dog will howl pite-

ously in response to another dog's howl; similarly a child of nine and a half months has been known to cry violently when its mother or father pretends to cry.

One curious manifestation of this early imitative sympathy is the impulse to do what the mother does and to be what she is. Much of early imitative play shows this tendency. It is more than a cold, distant copying of another's doings; it is full of the warmth of attachment, and it is entered on as a way of getting nearer the object of attachment. Out of this, too, there springs the germ of a higher sympathy. It will be remembered that Laura Bridgman bound the eyes of her doll with a bandage similar to the one she herself wore. Through this sharing in her own experience the doll became more a part of herself. Conversely, a child, on finding that her mother's head ached, began imitatively to make believe that her own head was hurt. Imaginative sympathy rests on community of experience, and it is curious that a child, before he can fully sympathize with another's trouble and make it his own by the sympathetic process itself, should thus show the impulse to procure by a kind of childish acting this community of experience.

From this imitative acting of another's trouble so as to share in it, there is but a step to a direct sympathetic apprehension of it. How early a genuine manifestation of concern at another's misery begins to show itself, it is almost impossible to say. Children probably differ greatly in this respect. I have, however, one case which is so curious that I can not forbear to quote it. It reaches me, I may say, by a thoroughly trustworthy channel.

A baby, aged one year and two months, was crawling on the floor. An elder sister, Katherine, aged six, who was working at a wool mat, could not get on very well, and began to cry. Baby looked up and grunted, "On! on!" and kept drawing its fingers down its own cheeks. Here the aunt called Miss Katherine's attention to baby, a device which merely caused a fresh outburst of tears. Whereupon baby proceeded to hitch itself along to Katherine with many repetitions of the grunts and the finger gestures. Katherine, fairly overcome by this, took baby to her and smiled. At which baby began to clap its hands and to crow, tracing this time the course of the tears down its sister's cheeks.

This pretty nursery picture certainly seems to illustrate a rudiment of genuine fellow-feeling. Similarly, it is hard not to recognize the signs of a sincere concern when a child of two will run spontaneously and kiss the place that is hurt, even though it is not to be doubted that the graceful action was learned through imitation.

Very sweet and sacred to the mother are the child's first clear indications of concern for herself. These are sporadic, springing

up rarely, and sometimes, as it looks to us, capriciously. Illness and temporary removal are a common occasion for the appearances of a deeper tenderness in the young heart. A little boy of three spontaneously brought his story book to his mother when she lay in bed ill; and the same child used to follow her about after her recovery with all the devotion of a little knight.

Very quaint and pretty, too, are the first attempts of the child at consolation. A little German girl, aged two and a half, had just lost her brother, and seemed very indifferent for some days. She then began to reflect and to ask about her playmate. On seeing her mother's distress she proceeded in truly childish fashion to comfort her: "Never, mind mamma, you will get a better boy. He *was* a ragamuffin" (*"Er war ein Lump"*). The coexistence of an almost barbarous indifference for the dead brother with practical sympathy for the living mother is characteristic here.

A deeper and more thoughtful sympathy comes with years and reflective power. Thought about the overhanging terror, death, is sometimes the awakener of this. "Are you old, mother?" asked a boy of five. "Why?" she answered. "Because," he continued, "the older you are the nearer you are to dying." This child had once before said he hoped his mother would not die before him, and this suggests that the thought of his own forlorn condition was in his mind here; yet we may hope that there was something of disinterested concern too.

This early consideration frequently takes the practical form of helpfulness. A child loves nothing better than to assist you in little household occupations; and though love of activity and the pleasure of imitating, no doubt, count for much in these cases we can, I think, safely set down something to the wish to be of use. This inference seems justified by the fact that such practical helpfulness is not always imitative. A little boy of two years and one month happened to overhear his nurse say to herself, "I wish that Anne would remember to fill the nursery boiler." "He listened and presently trotted off, found the said Anne doing a distant grate, pulled her by the apron, saying, 'Nanna, Nanna!' (come to nurse). She followed, surprised and puzzled, the child pulling all the way, till, having got her into the nursery, he pointed to the boiler, adding, 'Go dare, go dare,' so that the girl comprehended and did as he bade her."

With this practical "utilitarian" sympathy there goes a wish to please in other ways. Sometimes this shows itself in a dainty courtesy, as when a little girl, aged three and a quarter, petitioned her mother in this wise: "Please, mamma, will you pin this with the greatest pleasure?" Regard for another's feelings was surely never more charmingly expressed than in the prayer that in

rendering this little service the helper should not only be willing but glad.

Just as there are these sporadic growths of affectionate concern and wish to please in relation to the mother and others, so there is ample evidence of kindness to animals. The charge of cruelty in the case of little children is indeed seen to be a gross libel as soon as we consider their whole behavior toward the animal world.

I have touched above on the vague alarms which this animal world has for tiny children. It is only fair to them to say that these alarms are for the most part transitory, giving place to interest, attachment, and fellow-feeling. In a sense a child may be said to belong to the animal community, as Mr. Rudyard Kipling's account of the Jungle prettily suggests. Has he not indeed at first more in common with the dog and cat, the pet rabbit or dormouse, than with that grown-up human community which is apt to be so preoccupied with things beyond his understanding, and in many cases at least to wear so unfriendly a mien? We must remember, too, that children as a rule know nothing of the prejudices, of the disgusts, which make grown people put animals so far from them. The boy C—— was nonplussed by his mother's horror of the caterpillar. A child has been known quite spontaneously to call a worm "beautiful."

As soon as the first fear of the strangeness is mastered a child will take to the animal. A little boy of fifteen months quickly overcame his fright at the barking of his grandfather's dog, and began to share his biscuits with him, to give him flowers to smell, and to throw stones for his amusement. This mastery of fear by attachment takes a higher form when later on the child will stick to his dumb companion after suffering from his occasional fits of temper. Ruskin gives in his reminiscences a striking example of this triumph of attachment over fear. When five years old, he tells us, he was taken by the serving man to see a favorite Newfoundland dog in the stable. The man rather foolishly humored the child's wish to kiss Leo (the dog), and lowered him so that his face came near the animal's. Hereupon the dog, who was dining, resenting the interruption of his meal, bit out a piece of the boy's lip. His only fear after this was lest Lion (the dog) should be sent away.*

Children will too at a quite early age betray the germ of a truly humane-feeling toward animals. The same little boy that bravely got over his fear of the dog's barking would, when nineteen months old, begin to cry on seeing a horse fall in the street. More passionate outbursts of pity are seen at a later age. A boy

* Præterita, pp. 105, 106.

of five years and nine months had a kitten of which he was very fond. One day, after two or three days' absence from the house, it came back with one foot much mutilated and the leg swollen, evidently not far from dying. "When" (writes the mother) "he saw it, he burst into uncontrollable tears, and was more affected than I have ever seen him. The kitten was taken away and drowned, and ever since (a month) he has shown great reluctance in speaking of it, and never mentions it to any one but those who saw the cat at the time. He says it is too sad to tell any one of it." The boy C——, when only four, was moved to passionate grief at the sight of a dead dog taken from a pond.

The righteous indignation of children at the doings of the butcher, the hunter, and others, which deserves a chapter to itself, shows how deeply pitiful consideration for animals is rooted in their hearts.

It is sometimes asked why children should take animals to their bosoms in this fashion, and lavish so much fellow-feeling on them. It seems easy to understand how they come to choose animals, especially young ones, as playmates, and now and again to be ruthlessly inconsiderate of their comfort in their boisterous gambols; but why should they be so affected by their sufferings and champion their rights so zealously? I think the answer is not hard to find. The sympathy and love which the child gives to animals grows out of a kind of blind, gregarious instinct, and this again seems to be rooted in a similarity of position and needs. As M. Compayré well says on this point: "He (the child) sympathizes naturally with creatures which resemble him on so many sides, in which he finds wants analogous to his own, the same appetite, the same impulses to movement, the same desire for caresses. To resemble is already to love."* I think, however, that a deeper feeling comes in from the first and gathers strength as the child hears about men's treatment of animals—I mean a sense of a common danger and helplessness face to face with the human "giants." The more passionate attachment of the child to the animal is the outcome of the widespread instinct of helpless things to band together. A mother once remarked to her boy, between five and six years old, "Why, R——, I believe you are kinder to the animals than to me!" "Perhaps I am" (he replied); "you see they are not so well off as you are." May there not be something of this sense of banding and mutual defense on the animals' side too? The idea does not look so absurd when we remember how responsive, how forbearing, how ready to defend a dog will often show itself toward a "wee mite" of a child.

The same outpourings of affection are seen in the dealings of

* *Op. cit.*, p. 108.

children with their toy babies and animals. Allowing for occasional outbreaks of temper and acts of violence, the child's intercourse with his doll and his toy "gee gee" is on the whole a striking display of loving solicitude—a solicitude which is at once tender and corrective, and has the enduring constancy of a maternal instinct. No one can watch the care given to a doll, the wide-ranging efforts to provide for its comfort, keeping it warm, feeding it, bathing it, tending it while sick and so forth, to make it look pretty, to make it behave nicely, approving, scolding, as occasion arises, and note the misery of the child when parted from it, without acknowledging that in this plaything humanized by childish fancy we have the very focus of the rays of childish tenderness; that in the child's devotion to its wooden pet we have a striking example of the truth that daily companionship and the habit of caring for a thing make it an inseparable part of us.

Lastly, the reader may be reminded that childish kindness and pitifulness extend to what look to us still less deserving objects in the inanimate world. The expression of pity for the falling leaves and for the stones condemned to lie always in one place, referred to above, shows how quick childish feeling is to detect what is sad in the look of things. Children have even been known to apply the commiserating vocable "poor" to a torn paper figure and to a bent pin. It seems right to suppose that here too the tender heart of the child saw occasion for pity.

It is worth noting that childish sorrow at the sufferings of things is sometimes so keen that even artistic descriptions which contain a "cruel" element are shunned. A little boy under four "is indignant [writes his mother] at any picture where an animal suffers. He has even turned against several of his favorite pictures—German *Bilderbogen*—because they are 'cruel,' as the bear led home with a corkscrew in his nose." The extreme manifestation of this shrinking from the representation of animal or human suffering is dislike for "sad stories." The unsophisticated tender heart of the child can find no pleasure in horrors which appear to be the crowning delight of many an adult reader.

Here, however, it is evident we verge on the confines of sentimental pity. It is worth remarking that it is the highly imaginative children who shed most tears over these fictitious sufferings. Children with more matter-of-fact minds and a practical turn are not so affected. Thus a mother writes of her two girls: "M——, being the most imaginative, is and always has been much affected by sad stories, especially if read to her with dramatic inflections of voice. From two years old upward these have always affected her to tears, while P——, who is really the most tender-hearted and helpful, but has little imagination, never cries at sad stories,

and when four years old explained to me that she did not mind them because she knew they didn't really happen."

It appears to me to be incontestable that in this spontaneous outgoing of fellow-feeling toward others, human and animal, the child manifests something of a truly moral quality. C——'s stout and persistent advocacy of the rights of London horses against the oppression of the bearing-rein had in it something of righteous indigation. The way in which his mind was at this period preoccupied with animal suffering suggests that his sympathies with animals were rousing the first fierce protest against the wicked injustice of the world. The boy De Quincey got this first feeling of moral evil in another way through his sympathy with a sister who, rumor said, had been brutally treated by a servant. He could not, he tells us, bear to look on the woman. It was not anger. "The feeling which fell upon me was a shuddering horror, as upon a first glimpse of the truth that I was in a world of evil and strife." *

THE STUDY OF BIRDS OUT-OF-DOORS.†

By FRANK M. CHAPMAN.

WHETHER your object be to study birds as a scientist or simply as a lover of Nature, the first step is the same—you must learn to know them. This problem of identification has been given up in despair by many would-be ornithologists. We can neither pick, press, net, nor impale birds; and here the botanist and the entomologist have a distinct advantage. Even if we have the desire to resort to a gun its use is not always possible. But with patience and practice the identification of birds is a comparatively easy matter, and in the end you will name them with surprising ease and certainty. There is generally more character in the flight of a bird than there is in the gait of a man. Both are frequently indescribable but perfectly diagnostic, and you learn to recognize bird friends as you do human ones—by experience.

If you confine your studies to one locality, probably not more than one third of the species described in this volume will come within the field of your observation. To aid you in learning which species should be included in this third, the paragraphs on *range* are followed by a statement of the bird's standing at Wash-

* Autobiographical Sketches, chap. i.

† Being part of a chapter from the author's illustrated Handbook of Birds of Eastern North America recently issued by Messrs. D. Appleton & Co.

ington, D. C., Sing Sing, N. Y., and Cambridge, Mass., while the water-birds of Long Island are treated specially. Take the list of birds from the point nearest your home as an index of those you may expect to find. This may be abridged for a given season by considering the times of the year at which a bird is present.

After this slight preparation you may take to the field with a much clearer understanding of the situation. Two quite different ways of identifying birds are open to you. Either you may shoot them, or study them through a field- or opera-glass. A "bird in the hand" is a definite object whose structure and color can be studied to such advantage that in most cases you will afterward recognize it at sight. After learning the names of its parts, its identity is simply a question of keys and descriptions.

If you would "name the birds without a gun," by all means first visit a museum, and, with text-book in hand, study those species which you have previously found are to be looked for near your home. This preliminary introduction will serve to ripen your acquaintance in the field. A good field- or opera-glass is absolutely indispensable. A strong opera-glass with a large eye-piece is most useful in the woods, while a field-glass is more serviceable in observing water-birds. Study your bird as closely as circumstances will permit, and write *on the spot* a comparative description of its size, the shape of its bill, tail, etc., and a detailed description of its colors. In describing form take a Robin, Chipping Sparrow, or any bird you know, which best serves the purpose, as a basis for comparison. A bird's bill is generally its most diagnostic external character. A sketch of it in your note-book will frequently give you a good clew to its owner's family. It is of the utmost importance that this description should be written in the field. Not only do our memories sometimes deceive us, but we really see nothing with exactness until we attempt to describe it. Haunts, actions, and notes should also be carefully recorded. This account is your "bird in the hand," and while you can not hope to identify it as easily as you could a specimen, you will rarely fail to learn its name, and experience will render each attempt less difficult than the preceding.

Head of Barred Owl.

The best times of the day in which to look for birds are early morning and late afternoon. After a night of fasting and resting, birds are active and hungry. When their appetites are satisfied they rest quietly until afternoon, hunger again sending them forth in search of food.

Experience will soon show you the places where birds are most abundant. The more varied the nature of the country the greater number of species you may expect to find inhabiting it. An ideal locality would be a bit of tree-dotted meadow with a

HAIRY WOODPECKER.
YELLOW-BELLIED SAPSUCKER.

reed-bordered pond or stream, surrounded by woods, rolling uplands, and orchards.

Common sense will tell you how to act in the field. Birds are generally shy creatures and must be approached with caution. You must not, therefore, go observing or collecting dressed in flaming red, but in some inconspicuous garb and as quietly

as a cat. Furthermore, go alone and keep the sun at your back—two apparently unrelated but equally important bits of advice.

The collector generally has the instincts of a hunter, and practice will develop them. The "squeak" is one of his most valuable aids. It is made by placing the lips to the back of the hand or finger and kissing vigorously. The sound produced bears some resemblance to the cries of a wounded or young bird. In the nesting season its utterance frequently creates much excitement in the bird world, and at all times it is useful as a means of drawing bush- or reed-haunting species from their retreats. One may enter an apparently deserted thicket, and, after a few minutes' squeaking, find himself surrounded by an anxious or curious group of its feathered inhabitants.

HEAD OF CEDAR WAXWING.

The observer of birds will find that by far the best way to study their habits is to take a sheltered seat in some favored locality and become a part of the background. Your passage through the woods is generally attended by sufficient noise to warn birds of your coming long before you see them. They are then suspicious and ill at ease. But secrete yourself near some spot loved by birds, and it may be your privilege to learn the secrets of the forest.

During the year the bird life of temperate and boreal regions fluctuates with the changing seasons. Birds may thus be classed in the following groups according to the manner of their occurrence: Permanent residents are birds found in one locality throughout the year. Summer residents come from the south in the spring, rear their young, and leave in the fall. Winter visitants come from the north in the fall, pass the winter, and leave in the spring. Transient visitants pass through a given place in migrating to and from their summer homes north of it. Accidental visitants are birds which have lost their way. They are generally young and inexperienced, and are usually found in the fall.

GOLDEN-CROWNED KINGLET.

The best time of the year to begin studying birds is in the winter, when the bird population of temperate regions is at the minimum. The problem of identification is thus reduced to its simplest terms, and should be mastered before spring introduces new elements.

The commoner permanent residents of the middle Eastern States are the following:

Bob-white,	Hairy Woodpecker,
Ruffed Grouse,	Flicker,
Red-shouldered Hawk,	Blue Jay,
Red-tailed Hawk,	Crow,
Sharp-shinned Hawk,	Meadowlark,
Barred Owl,	American Goldfinch,
Long-eared Owl,	Purple Finch,
Screech Owl,	Song Sparrow,
Great Horned Owl,	White-breasted Nuthatch,
Downy Woodpecker,	Chickadee,

and occasionally the Waxwing, Myrtle Warbler, Bluebird, and Robin. To these should be added the following more or less common winter visitant land-birds:

Saw-whet Owl,	Tree Sparrow,
Horned Lark,	Junco,
Snowflake,	Northern Shrike,
Lapland Longspur,	Winter Wren,
Redpoll,	Golden crowned Kinglet,
American Crossbill,	Brown Creeper,
White-throated Sparrow,	

Let us now begin with the opening of the spring migration and briefly review the ornithological year. In the vicinity of New York city the first birds arrive from the south late in February or early in March. There is much variation in the coming of these early birds. Later, when the weather is more settled, migrants arrive within a few days of a given date. In April most of our winter visitants leave for the north. The current of migration grows steadily stronger until about May 12th, when high-water mark is reached. Then it rapidly subsides, and the spring migration is practically over by June 1st. The winter visitants have gone, the great army of transients has passed us, and our bird population is now composed of permanent residents with the addition of about ninety summer residents.

Nesting time has arrived, and birds which for nearly a year have been free to go and come as inclination directed, now have homes where, day after day, they may be found in tireless attendance upon the nest and its treasures. Courtship, the construction of a dwelling, the task of incubation, and care of the young, all tend to stimulate the characteristic traits of the bird, and at no other time can its habits be studied to better advantage.

But resident birds begin building long before the migration is concluded. The Great Horned Owl lays in February, other birds

in March and April; still, the height of the breeding season is not reached until June 1st.

Another period in the avian year closely connected with the spring migration and nesting time is the song season. Near New

Song Sparrow.
Swamp Sparrow.

York city it is inaugurated late in February by the Song Sparrow. Voice after voice is added to the choir, and in June our woods and fields ring with the chorus so dear to lovers of Nature. By the middle of July it is on the wane, and early in August it is practically over. Some birds have a brief second song season in

the fall, but as a rule it lasts only a few days—it is a farewell to their summer homes.

August is a most discouraging month to the student of birds. Birds leave their accustomed haunts and retire to secluded places to renew their worn plumages. They are silent and inactive, and therefore difficult to find. Late in the month they reappear clad in traveling costumes and ready for their southern journey. One by one they leave us, and there are days late in August and early in September when the woods are almost deserted of birds. Later the fall migration becomes continuous, and each night brings a host of new arrivals.

The spring migration is scarcely concluded before the fall migration begins. July 1st, Tree Swallows, which rarely nest near New York city, appear in numbers from the north and gather in immense flocks in our marshes. Later in the month they are joined by Bobolinks. Early in August the careful observer will detect occasional small flights of Warblers passing southward, and by September 10th the great southern march of the birds is well under way; it reaches its height between the 20th and last of the month, when most of the winter residents arrive, and from this time our bird life rapidly decreases. Some of the seed- and berry-eaters remain until driven southward by the cold weather in December. When they have gone our bird population is again reduced to the ever-present permanent residents and hardy winter visitants.

In a careful study of the great divine's works, the Rev. J. A. Zahm finds that St. Augustine clearly distinguishes between creation, properly so called, and the work of formation and development. The former was direct and simultaneous, while the latter, he contends, was gradual and progressive. "As there is invisibly in the seed," he affirms, "all that which in the course of time constitutes the tree, so also are we to view the world, when it was created by God, as containing all that which was subsequently manifested, not only the heavens with the sun and moon and stars, but also those things which he produced potentially and causally, from the waters and the earth, before they appeared as we now know them." The formless matter, which God created from nothing, was first called heaven and earth, and it is written that "in the beginning God created heaven and earth," not because it was forthwith heaven and earth, but because it was destined to become heaven and earth. When we consider the seed of a tree, we say that it contains the roots, the trunk, the branches, the fruits, and the leaves, not because they are already there, but because they shall be produced from it. "Verily," says Mr. Zahm, "in reading these words, we can fancy that we are perusing some modern scientific treatise on cosmogony instead of an exposition of Genesis written by a father of the Church fifteen hundred years ago."

ANCESTOR-WORSHIP AMONG THE FIJIANS.*

By BASIL H. THOMSON.

THERE are more gods than tribes among the Fijians, and it is manifestly impossible to give an account of the religions of them all within reasonable limits; hence I take as a type the tribes inhabiting the northern and eastern portions of the island of Viti-Levu, the part of the group first colonized by Fijians. Like the Greeks, the Fijians made their gods as beings of like passions with themselves; but whatever may have been the fountain head of Greek mythology, it is clear that the Fijians humanized their gods, because they had once existed on earth in human form. Their mythology was traditional history. Like other primitive peoples, the Fijians deified their ancestors. The father ruled the family. Each member of it turned to him for the ordering of his daily life. No scheme entered the head of the young man that did not depend upon the consent or prohibition of the head of his family. Suddenly the father died. How were his sons to rid themselves of the idea of his controlling influence that had guided them ever since they were born, even though they had buried his body? He had been wont to threaten them with punishment for disobedience, and even now, when they did the things of which he disapproved in life, punishment was sure to follow—the crops failed, a hurricane unroofed the hut, floods swept away the canoe.

If they won a victory over their enemies, it was he who had strengthened their arms in response to their prayers and offerings. Then each son of the dead father founded his own family, but still owed allegiance to their eldest brother, who represented their father as the head of the joint family. Generations came and went; the tribe even increased its tens to hundreds, but still the eldest son of the eldest, who carried in his veins the blood of the common ancestor in its purest form, was venerated as the head of the tribe. The name of the ancestor was not forgotten. He was now a god, and had his temple and his priests, who had themselves come to be hereditary and had the strong motive of self-interest for keeping his memory green. My belief is that the extra-tribal mythology of the Fijians is in fact legendary history, that the gods that peopled their Olympus had been the men who were the founders of their race. The story of their origin, history, and beliefs is contained in a poem, the Saga of Nakauvadra, by an unknown author, a specimen of which follows:

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* Abridged from an address delivered before the Anthropological Institute of Great Britain and Ireland, and published in the Journal of the Anthropological Institute.

"Ko Degei sa tagi lagalaga,
Bogi Dua, bogi rua ka'u yadra,
Bogi tolu, bogi va ka'u yadra,
Sa tubu dugn dina ko Turukawa."

In a distant land to the far westward were three chiefs, Lutunasobasoba, Degei, and Waicalanavanua. For some cause, long since forgotten, they resolved to leave this land with their wives and children, and they sent a messenger to the head craftsman Rokola, bidding him build them a great canoe, which they called the *kaunitoni*. In her they set sail, and with them went a number of other canoes, all seeking a new land. They found many lands, and at each some of the people stayed to make it their adopted home; but none of them pleased Lutunasobasoba. At last the *kaunitoni* was left alone, and for many days she sailed and found no land. And then a great storm came up from the westward and struck her, and the waves swept her deck, carrying overboard all their goods, and among them a basket of inscriptions. So for many days she drove before the western gale, and all hope of gaining land left them. But at last they saw high land, and knew that they were saved; and they beached their canoe on a sandy shore, and built themselves huts and called the place *Vuda* (Our Origin). This is the *Vuda* on the northwest corner of *Viti-Levu*. The saga goes on to relate the distress of Lutunasobasoba at losing his basket of inscribed stones. I have not succeeded in finding any contemporary tradition that throws light on this very important passage. The Fijians, when we Europeans first came into contact with them, had no knowledge of any kind of writing, nor even of making rude representations of natural objects in their carving. But the poem says:

"Lutunasobasoba wept bitterly:
'My descendants will be in pitiable plight,
My basket of stones is overset,
My writings (vola) have fallen out.'"

It goes on to relate how he sent out the canoe to look for the lost inscriptions (which, if they really were of stone, was a somewhat futile proceeding), and how the crew of the canoe discovered the Yasawa Islands, but came back without the lost records.

They stayed at Vuda until Lutunasobasoba became very old and infirm, and then they decided to move him to higher ground. Degei, who had now taken the lead of the party, ordered Rokola to build some new canoes to carry them to the eastward. The tribe had become too large for the *kaunitoni*. When these were ready the fleet crept along the coast to the eastward, and landed in what is now the bay of Rakiraki. Thence the dying Lutunasobasoba was carried up the mountain, and a hut was built of which the posts and walls and thatch were all made of the vadra

or pandanus tree, and from this hut or the profusion of this tree the mountain took its name of Nakauvadra. Here Lutunasobasoba lived several years, and when at last he felt his end to be near he summoned his children around him and gave them his dying commands, ordering them to separate and settle in different parts of the wide land he had discovered. Under these conditions Fiji was peopled, and the greater part of the saga is taken up with the wanderings of these children. Besides being the dwelling place of their gods, Nakauvadra Mountain was the first circle of the Fijian inferno, the point of departure for the unseen world that lay to the westward. Nearly all South Sea islanders point to some spot on their island where the spirits of the dead leap into the ocean to be ferried over to the world of shades. These "jumping-off places" (thombothombo) are generally steep cliffs facing the place whence tradition says the race originally came. Whatever may become of the soul hereafter, to Nakauvadra it must first betake itself before leaping into the ocean. From the populous district of the Lower Rewa there is but one path to the Nakauvadra Mountain, called the "Sala ni Yalo" (Path of the Shades). Chance led to its discovery, or rediscovery, if it is true that Europeans had before noticed it. Last year a surveyor was sent to traverse the boundaries of lands claimed by the tribe of Namata. His native guides led him along a high ridge, the watershed between the river Rewa and the eastern coast of the island. As they cut their way through the undergrowth that clothed the hilltop, he noticed that the path was almost level, and seldom more than two feet wide, and that the ridge joined hilltop to hilltop in an almost horizontal line. The surveyor had a patch of the undergrowth cleared away and found that without doubt the embankments were artificial. Following the line of the ridge, the valleys had been bridged with banks thirty or forty feet high. The level path thus made extended, so the natives said, clear to Nakauvadra, fifty miles away. For a people destitute of implements this was a remarkable work. I thought at first that this was a fortification on a gigantic scale, for Fijians never undertake any great work except for defense, under the spur of a pressing necessity. It could not be a road, because the ancient Fijians preferred to go straight over obstacles, like the soldier ants in Africa, that climb trees rather than go round them. The old men at Bau, whom I questioned, knew nothing of its history except that it was called "The Path of the Shades," and that it was an extension of one of the spurs of the Kauvadra Mountain. I asked for guides to take me over it, and they chose three gray-headed elders of the Namata tribe. We started in heavy rain. My guides were reticent at first, but as we went on the spirit of the place seemed to possess them, and at each turn of the path they stopped to describe to me the particular dan-

ger that there beset the passing shade. The eldest of the three became at times positively uncanny, for he stopped here and there in the driving rain to execute a sort of weird gamboling dance, whether out of pure excess of spirits or a praiseworthy intention of exorcising the gods of the place I do not know. Little by little I wormed out of them the whole tradition, with fragments of the sagas in which it was preserved. After I got home I set two of my native collectors to write it all down. It is far too long to give here in its entirety, but I will try to condense it.

Long ago—so long ago that the tradition has become dim—the ghosts of the dead used to annoy the living. They whistled in the houses, turned the yams rotten in the ground, filled the cooking pots with live snakes, or played some other of the pranks in which the Fijian ghost delights. And the living reasoned with themselves, and found that it was because of the bad state of the road to Nakauvadra that the shades could not find their way to the sacred mountain, and so they stayed about their old haunts. So the tribes banded together and built a road for the ghosts of their dead to travel over, and thenceforward they did not stay to annoy the living.

When a man died, his body was washed and laid in its shroud, and a whale's tooth was put upon his breast to be his stone to throw at the pandanus tree; and while his friends were still weeping, his spirit left the body and went and stood on the bank of the "Water of the Shades" (Wainiyalo), at the place called Lelele—the ferry—and cried to Ceba, the ghostly ferryman, who brought the end of his canoe which was of hard *vesi* if it was for a chief, but the end that was of breadfruit wood for a vulgar shade.

Across the stream the shade climbed the hill of Nathegani, where grew the pandanus tree. And he threw his whale's tooth at it, and if he hit it he sat down to await the coming of his wife, who, he now knew, was being strangled to his manes; but if he missed the pandanus tree he went on, weeping aloud, for he knew that his wife had been unfaithful to him in life, and that she cared not to be strangled to accompany him. Then he came to the ghost scatterer, Droydroyalo, who strode toward him and pounded his neck with a great stone, scattering the *ndawa* fruit he was carrying to eat on his journey. Thence he journeyed to Drekei, where dwell the twin goddesses Nino, who crept on him, peering at him, and gnashing their terrible teeth; and the shade shrieked in terror and fled away. As he fled up the path he came to a spring and stopped to drink; and as soon as he tasted the water he ceased weeping, and his friends also ceased weeping in his home, for they straightway forgot their sorrows and were consoled. Therefore this spring is called the Wai-ni-dula—Water of Solace. And when he stood erect from drinking, he looked afar

off, and saw the white *buli* shells gleaming on the roofs of the great dwellings of Nakauvadra; and he threw away the *via* roots he was carrying, for he knew that he was near his resting place and would want no more provisions for the journey. So he flung away his *via*, to travel unencumbered, and to this day you may see the *via* sprouting where the shades threw it. Going on, the shade had many adventures. He was crippled by Tatovu's axe; he was wounded by Motoduruka's reed spear; he crawled forward on his belly; he bowed ten times; he fainted away, and was dragged onward as corpses are dragged to the cannibal ovens; he had to pinch the "pinching stone" to see whether his nails are long, for if the stone is indented, it is a sign that he was lazy in his lifetime, and that his nails are not worn away by scooping up the yam hills in his plantation. From the "pinching stone" he went onward, dancing and jesting, till he came to Taleya, the Dismisser, who asked him how he died—whether by the club, or the strangling cord, or the water, or naturally of disease or old age. And if he said he died of violence, the Dismisser let him journey onward, but if he said that he died naturally, he was commanded to re-enter his body; but not all of these obey, so anxious are they to reach Nakauvadra. Thus the Fijians explained recoveries from trances and epileptic seizures. He goes on through myriad adventures and dangers, and it is entirely out of the question to give them all. One of the most curious is that of the vasa tree at Nailililli—the "hanging place." From the branches of this tree are hanging the souls of little children, like bats, waiting for their mothers to come and lead them onward, and they cry to the passing shades, "How are my father and my mother?" If the shade answers, "The cooking fire of your mother is set upright," the child ghost wails aloud, knowing that it must still wait, for its mother is still in her prime; but if the shade answers, "Their hair is gray, and the smoke of their cooking fire hangs along the ground," the child laughs with joy, crying: "It is well! my mother will soon be here. Oh, let her hasten, for I am weary of waiting for her!"

I wish that space permitted me to follow the journey of the Fijian shade to its end. The folklore of a people spontaneously developed and uninfluenced from without will always have an interest of its own, because of the light it throws upon the genesis of religions. Many of us have heard of the Fijians as the most striking example of the success of missionary enterprise. Their conversion, however, was in most cases a political move. The chief found it convenient to "*lotu*," and his people of course followed him. In one of these cases the missionary attended a meeting of the tribe to receive their conversion to Christianity. The heathen priest took his seat near the piled-up feast, and thus ad-

dressed the ancestor gods: "O ye, our fathers! be not angry with us. We, your children, bring you this miserably inadequate feast from our impoverished gardens, this wretched root of yagona for you to drink. We are poor, we are miserable. And another thing —be not angry with us if, for a while, we give up worshiping you. It is our mind to worship the foreigner's God for a while, yet, nevertheless, be not angry with us." Then the ancestor gods ate the spiritual essence of the yams, and the missionary lunched on its grosser material fiber, and enjoyed it greatly.

In 1876 the natives of Fiji had all nominally embraced Christianity—outwardly they conformed to the new faith—but at the end of 1885 strange rumors were brought to the coast by native travelers from the mountains. A prophet had arisen, who was passing through the villages, saying to the people, "Leave all and follow me." His teachings were an ingenious compound of Christianity and heathenism. He said that when Nacirikaumoli and Nakausabaria (two of the ancestral chiefs, described in their Saga) sailed away after their defeat by Degei, they went to the land of the white men, who wrote a book about them, which is the Bible; only they lied about their names, falsely calling them Jehovah and Jesus. They were about to appear and bring with them all the ancestors of the Fijians. The millennium would come, the missionaries and the Government would be driven into the sea, and every one of the faithful would have shopfuls of English goods. Those who believed that he was sent before to prepare their way would have immortality, but the unbelieving would perish. The white men who came in the men-of-war, looking through glass instruments, who falsely said that they were surveying, were really looking for the coming of the divine twins. In the meantime the faithful were to drill as soldiers and the women to minister in the temples. Temples were secretly built at Drau-ni-ivi and other places, and behind the curtain, where the priest and the women sat, the god might be heard to descend with a low, whistling sound. There was some controversy between the faithful whether Degei was God or the devil. Many inclined to the latter belief, because Satan took serpent form, and the traditions describe Degei as a gigantic serpent lying coiled in his cave in Uakauvadra, and causing thunder when he turns his huge bulk. The new prophet fixed the day for the resurrection of the ancestors, but he was arrested and deported to Rotuma, and the outbreak was stamped out for a time; but in 1892 it reappeared, and the Government then decided to remove the village of Drau-ni-ivi, the fount of all these superstitions, and the houses were removed and the site leveled to the ground. We have by no means, however, heard the last of Fijian mythology. There was another outbreak about a year ago.

FRUIT AS A FOOD AND MEDICINE.*

By HARRY BENJAFIELD, M. B.

And Eve saw that the tree was good for food, and that it was a delight to the eyes.—*Genesis.*

Stay me with raisins, comfort me with apples.—*Solomon.*

SUCH was the opinion of people who lived six thousand years ago, and all down through the succeeding ages poets have sung the praises of the luscious grape and peach, and painters have sought to outvie each other in depicting the attractions of the apple and plum, and away deep down below all this we see throughout the whole animal creation a developed instinct which teaches all to long after these beautiful fruits. Is this instinct wrong? Is Nature a fool thus to make her creatures voice their needs? When you see the whole insect family swarming over and voraciously devouring our choicest fruits, shall we say that they do not know what is good for them? When we see pigs, horses, cows, and sheep breaking down our fences, need we ask how they learned to love fruit? Ay, more, note the baby in arms who screams for the rosy apple, and bites away at it even with toothless gums, and as the baby grows into the boy how he will defy canes, and even police, so that he can get what he loves and longs for. The Creator is so anxious that this very necessary food shall be eaten by his creatures that he makes it beautiful to look upon, sweet and attractive in smell, and gives to it such varieties of flavors that the most fastidious can be satisfied. And yet in spite of all this the great mass of the people look upon fruit as a luxury upon which they can only spend odd pennies for the amusement of their children. Many parents will more readily spend money on injurious or even poisonous sweets than they will on good healthy fruit, and fashionable society will spend pounds on cakes, wines, and brandies, while they spend as many shillings on the very thing they need to keep them healthy —fruit. And as for the amount of drugs swallowed which should be replaced in great measure by fruit it is beyond my powers to calculate. Millions upon millions of pounds are spent annually upon mercurial and other purgatives, most of which would be quite unnecessary if the people would but look upon fruit as a necessary article of diet. The fruit grower of the future must try to so educate the public mind that this state of things will be

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* From advance sheets of a lecture delivered before the Australasian Federated Fruit-growers' Association at the Tasmanian Exhibition Building, Queen's Domain, Hobart, April 26, 1895.

altered. The man who makes sweets does not just make them and do nothing to induce the public to buy. No; first he puts them up in all sorts of tempting boxes or packages, then he pushes the sale in various ways. The men who make beers, brandies, etc., not only do this, but they go further, they provide all kinds of places where they shall be taken, they provide the gin palace with all its attractions of club rooms, billiards, daily papers, besides plenty of pretty girls to wait on their customers. Why should we not have fruit palaces where, at reasonable prices, people could get the choicest fruit at any hour of the day?

Eve is said to have seen that fruit was good for food. Every generation since has indorsed her opinion, and now perhaps more than ever before the world is waking up to see how good a food it really is. Good ripe fruits contain a large amount of sugar in a very easily digestible form. This sugar forms a light nourishment, which, in conjunction with bread, rice, etc., form a food especially suitable for these warm colonies;* and when eaten with, say, milk or milk and eggs, the whole forms the most perfect and easily digestible food imaginable. For stomachs capable of digesting it fruit eaten with pastry forms a very perfect nourishment, but I prefer my cooked fruit covered with rice and milk or custard. I received a book lately written by a medical man advising people to live entirely on fruits and nuts. I am not prepared to go so far—by the way, he allowed some meat to be taken with it—for, although I look upon fruit as an excellent food, yet I look upon it more as a necessary adjunct than as a perfect food of itself. Why for ages have people eaten apple sauce with their roast goose and sucking pig? Simply because the acids and pectones in the fruit assist in digesting the fats so abundant in this kind of food. For the same reason at the end of a heavy dinner we eat our cooked fruits, and when we want their digestive action even more developed we take them after dinner in their natural, uncooked state as dessert. In the past ages instinct has taught men to do this; to-day science tells them why they did it, and this same science tell us that fruit should be eaten as an aid to digestion of other foods much more than it is now. Cultivated fruits such as apples, pears, cherries, strawberries, grapes, etc., contain on analysis very similar proportions of the same ingredients, which are about eight per cent of grape sugar, three per cent of pectones, one per cent of malic and other acids, and one per cent of flesh-forming albuminoids, with over eighty per cent of water. Digestion depends upon the action of pepsin in the stomach upon the food, which is greatly aided by the acids of the stomach. Fats are digested by these acids and the bile from

* Australia.

the liver. Now, the acids and pectones in fruit peculiarly assist the acids of the stomach. Only lately even royalty has been taking lemon juice in tea instead of sugar, and lemon juice has been prescribed largely by physicians to help weak digestion, simply because these acids exist very abundantly in the lemon.

Another great action of fruit in the body is its—shall I call it—antiscorbutic action. It keeps the body in a healthy condition. When out on a long voyage where fruit is scarce how one longs for it! Those who have been without it for an extended time long for it until even in their dreams they picture the fruit their system so badly needs. The following case will illustrate my meaning: A ship's crew had any amount of fresh meat, new bread, tea, coffee, etc., aboard, but no fruit nor vegetables. As days went by the men grew haggard, breathless, and weak, with violent, tearing rheumatic pains in the joints. Then the gums grew spongy, the blood broke through its veins, and the whole system was demoralized and dying. In short, they were dying of scurvy. A fruit ship passing sent aboard a good supply of oranges and lemons, which were greedily eaten by the sufferers. Mark the the result: though they still went on eating the same food the addition of fruit to their diet made all the difference between life and death. In a few days their gums began to heal, the blood became healthy, natural color came in their faces, and strength came to the limbs so lately racked with pain. This is, perhaps, an extreme illustration, but I am satisfied that in a lesser degree the want of fruit is responsible for much of the illness in the world. When a student I remember sitting beside a leading London surgeon as an unhealthy child was brought in suffering from a scrofulous-looking rash over the face. Turning to us he exclaimed, "That is a rash from eating lollies." And many times since have I had occasion to remember his teaching, as I have seen it verified. Good fruit clears the blood and prevents this sort of thing. This lemon-juice cure for rheumatism is founded on scientific facts, and having suffered myself from acute gout for the last fifteen years, I have proved over and over again the advantages which are obtained from eating fruit. Garrod, the great London authority on gout, advises his patients to take oranges, lemons, strawberries, grapes, apples, pears, etc. Tardieu, the great French authority, maintains that the salts of potash found so plentifully in fruits are the chief agents in purifying the blood from these rheumatic and gouty poisons.

Perhaps in our unnatural, civilized society, sluggish action of the bowels and liver is responsible for more actual misery than any other ailment. Headache, indigestion, constipation, hæmorrhoids, and a generally miserable condition, are but too often the experience of the sufferer, and to overcome it about half the drugs

in the world are given in all sorts of compounds. Let the man of drugs go aboard that ship in mid ocean, with its crew suffering from all these ailments; let the man with his artificially made fruit salts have his trial at their bowels and liver; let the man of mercury and podophyllum, and all the so-called liver doctors try their best; call in the tribes of tonics, and give iron, quinine, arsenic, strychnia, and all the rest of the family; then try your stomachics for his digestion, but in spite of all these the scurvy fiend will sit aloft and laugh you to scorn. In fact, all these drugs have been tried over and over again, and Dr. Buzzard, perhaps the greatest authority in the world, tells us they have all proved miserable failures. But bring in your fruit and the whole scene changes. Can not we show the world that what is applicable to these men in their extreme condition is more or less applicable to the millions of sufferers on land who now persist in looking upon fruit as a thing they can very well do without? Dr. Buzzard advises the scorbutic to take fruit morning, noon, and night. "Fresh lemon juice in the form of lemonade is to be his ordinary drink; the existence of diarrhœa should be no reason for withholding it. Give oranges, lemons, apples, potatoes, cabbage, salads," and if this advice is good for those aboard, and there is no doubt about that, it is equally good for the millions who are spending millions annually in drugs which will never cure them. The first symptoms of scurvy are a change in the color of the skin, which becomes sallow or of a greenish tint. Then follows an aversion for all exercise. Bloodshot eyes, weak heart, bad digestion, and constipation follow on. Dr. Ballard says many of the most serious and fatal cases of scurvy he has seen have only presented as symptoms the pallid face, general listlessness, and bloodshot eyes. If we go through the back streets of our large towns how many pallid faced, listless-looking people and children swarm around us, and they have, as a rule, plenty of food! Within the last few weeks two of my own children have given me a good example of what fruit will do. Two months ago I decided to let these two boys, aged six and eight, go to my farm among the apple-packers. They were not actually ill when they went out, neither had they been at all shut up, but they were pale-looking, would not eat their food, etc. During the last two months they make their boast they eat a dozen apples a day each, and as soon as they began eating these apples their appetite for other foods about doubled, and during the eight weeks they have grown stout and robust, skin clear and healthy, with the glow of health on their cheeks, and bodily strength equal to any amount of exertion.

As a medicine, I look upon fruit as a most valuable ally. As previously shown, when the body is in that breaking-up condition

known as scurvy, the whole medical profession look upon fruit and fresh vegetables as the one and only known remedy. I believe the day will come when science will use it very much more largely than it does now in the treatment of many of the every-day ailments. I have shown how it aids digestion. Observations in scurvy prove that it exerts a very powerful influence on the blood. But "the blood is the life": poor blood means poor spirits, poor strength, poor breath, and poor circulation. Impure blood means gout, rheumatism, skin diseases, rickets, and other troubles. As it is proved that fruit will purify and improve the quality of the blood, it must follow that fruit is both food and medicine combined. In fevers I use grapes and strawberries, giving them to my patients in small but frequent doses—oranges and baked apples, if the others are not obtainable. For rheumatism, plenty of lemons are invaluable. White girls with miserable, pallid complexions want a quart of strawberries a day; where these are not obtainable, bananas, which contain much iron, are a good substitute. Probably, of all fruits, the apple stands unrivaled for general purposes in the household; either raw or cooked it can be taken by nearly everybody, and it contains similar properties to the other more delicate fruits. To my mind the pear is more easily digested than the apple, and for eating uncooked is superior to it. In our climate we can have good dessert pears nine months in the year, and their culture should be much increased.

Dried fruits are now occupying more attention than perhaps they have ever done before. It has been proved in a large way by giving troops dried vegetables and fruits that the attack of scurvy could be warded off, but in curing scurvy they were nowhere alongside green. Still it teaches us that dried fruits should be used when green can not be obtained. If soaked for a few hours before cooking they make a capital substitute for fresh fruit, and they come cheaper to the consumer. I wonder that miners, sailors, and others do not use dried fruits very largely.

For preserving fruit I look upon bottling in glass bottles as the coming thing. Not by the use of chemicals, such as salicylic and boracic acids, and the various preservatives made from them, but simply by protecting it after cooking from the fermentative germs in the atmosphere. It keeps for years, turns out even more palatable than green fruit, is equally digestible, and contains all the virtues of freshly cooked fruit. When bottles are made in Australia at a cheap rate this will be a great industry. Canned fruit is not so good; the acid of the fruit dissolves up tin and lead from the tin, and I have seen very serious cases of illness as a result. Besides, fruit should be sold much cheaper in bottles than in tins, as the bottle can be returned and used again.

Jams made from nice fresh fruit, and put up in glass or ware, make a very good article of diet; but much of the jams of commerce should be used as food for pigs. Jams act on tin and lead very much like tart fruits, but the acid in them is greatly neutralized by the sugar. Still, I have seen the outside of the jam in a tin quite discolored.

Solomon said, "Stay me with raisins, comfort me with apples," so great and wise kings six thousand years ago wished to be fed with dried fruit and apples. In this highly enlightened age it is nothing to our credit that we pay less attention to our diet than these old patriarchs did. They thought more of their vineyards than they did of their cattle. When Moses sent the spies into Canaan they were told to bring back samples of the fruit it bore, and they brought back not a fat bullock but a very fat bunch of grapes. A medical writer has recently been maintaining that bread and other starchy food, containing as they do large quantities of lime, are responsible, especially in aged people, for many of the diseases from which we suffer, such as apoplexy, rheumatic gout, etc., and urged that fruit should be taken freely instead, to counteract these limy effects. One of the first symptoms, when people are deprived of fruit and vegetables, is very severe pain in the joints like rheumatism, and death from failure of the heart's action. Whether he is right about this lime may not be proved, but there is no doubt but lime exists too largely in the blood vessels in these diseases, and if fruit were eaten regularly it would do much to prevent it. Science to-day tells us that we may live under the most beautiful conditions, we may feast on bread, meat, eggs, rice, cocoa, oatmeal, and such like foods for a short time, but unless we take fruits or fresh vegetables—fruits being the best—we shall get listless, with leaden face, etc., until we die in a few months at the longest; and it follows that if we would keep ourselves and our children with clear skins, bright intellects, good digestion, rich colored, healthy blood and strength for work, we must regularly take fruit and vegetables, and look upon them as actually more necessary for the support of good health than any other article of diet.

WHILE among the Mongols of the borders of Tibet, Mr. W. W. Rockhill heard a story, said to be widespread among the people, that some five hundred years ago a foreign emperor, desirous of knowing what was in the sun, took fifty Mongol men and as many women, and, shutting them up in a crystal casket that had the power of flying, started them on a voyage of discovery to that star. Nothing has been heard of the explorers since then, and the Mongols bear a grudge against the emperor, whoever he may have been, who served their people so ill.

ONLY A MATCH.

By C. FALKENHORST.

IF one should count the matches that are used daily he would arrive at an immense sum—in the *milliards*, at least. To supply the immense demand for the little sticks which so quickly go out in fire and flame, a great number of factories on either side of the ocean are busy with steam and noisy machines; while we have become so indifferent that we see nothing special in the fire-bearing splinters, and are vexed when one of them fails, or the hissing head breaks off, or the flame goes out, leaving the wood to glimmer.

We shall really have to go among savages to learn to admire the match. Take the white traveler in darkest Africa, in the midst of naked negroes, who see a civilized man for the first time. He carelessly brings out his matchbox to light his cigar. A slight movement of the hand, and the blaze flickers; the crowd of black spectators, frightened, fall back and run away, crying, "Witch! witch!" These negroes are really not savages. They possess fire, by which they warm themselves, and with the help of which they work metals, produce iron and forge it; but they still obtain fire in the primitive way, either by striking steel against flint or in the tedious method of a ruder antiquity by rubbing pieces of dry wood together, and not always with success. But the white man produces his flame as if by magic in an instant.

In the beginning of this century chemists discovered a number of substances which took fire more easily than dry wood or punk, and, as modern naturalists are mostly practical men, the thought occurred to them to make these substances available for the quicker production of fire. They found, for example, that chlorate of potash, now much used as a gargle in throat diseases, was decomposed and set fire to combustible substances as soon as it came in contact with concentrated sulphuric acid. The first practicable match was based upon this observation; a stick was covered at the end with a coating of sulphur, and over this was spread a mass of gum and chlorate of potash. When the head of the match was dipped in concentrated sulphuric acid, the chlorate of potash detonated and set fire to the inflammable sulphur, which imparted its flame to the wood. These were the dip matches, which were introduced in 1812, and were very popular. The sulphuric acid was kept in vials, from the stoppers of which asbestus threads hung down in the inside, and were thereby wet with the acid. If one wanted fire, he drew out the asbestus thread and pressed the head of the match upon it when the fire appeared.

Another property of chlorate of potash was discovered shortly afterward. Mixed with various substances—sulphuret of antimony, for example—a combination was produced which exploded, with issue of flame, on being rubbed. This mixture was first applied to matches by Johann Friedrich Kammerer in 1832. Having sulphured the end of the stick, he prepared an adhesive mixture of gum arabic, chlorate of potash, and sulphuret of antimony, dipped the stick in it, and let the whole dry. This new match was lighted by rubbing it, under pressure of the fingers, in a folded piece of sandpaper.

The use of phosphorus was the next improvement. That substance inflames readily when warmed to 50° C., or 122° F.—a temperature easily obtained by lightly scratching the match on a rough surface. Experiments had been made with this substance at the beginning of the century; but the first phosphorus matches were crude and unsafe. Pure phosphorus was kept under water in bottles, whence small bits of it were taken out and lighted by rubbing on leather. Kammerer, not being fully satisfied with his first composition, tried a new one containing phosphorus as well as chlorate of potash. After this there were no more failures of the matches to light, for the phosphorus took fire under the slightest friction and decomposed the chlorate of potash, which gave out the oxygen required to inflame the sulphur, and made a lively combustion possible. The idea found favor, and the first large factory of phosphorus matches was erected in Vienna by Stephan Römer and J. Preschel. This match, too, had its defects. The mixture of phosphorus and chlorate of potash exploded with such force as to be available for filling bombs. Some serious accidents occurred in the shops, and the transportation of the material was forbidden in several countries. The new matches were wild comrades that needed taming. At last the Vienna makers succeeded in replacing the chlorate of potash by other substances —such as minium, peroxide of lead, and manganese oxide—which gave out oxygen more slowly.

Objections were still brought against these matches. The burning sulphur emitted an offensive odor: to obviate this, paraffin was introduced in the place of sulphur as the substance in which the sticks should be dipped before finishing their heads. A more serious objection was founded on the poisonous nature of the vapor of phosphorus, by reason of which the use of even only a few matches at a time was attended with peril, and the workmen in the factories became subject to dangerous diseases. Yet the manufacturers would not give up phosphorus, and the public, having become accustomed to the new matches, demanded them, so that it was not feasible to prohibit the making of them, and the attention of the Government was rather directed to

devising the best provisions practicable for the safety of the workmen.

A curious coincidence occurred in 1845, when the attention of Lorinser in Vienna was first directed to phosphorus poisoning, and Römer, of the same city, discovered the amorphous or red form of phosphorus and the method of converting white phosphorus into it. This form of the element, taking fire at 250° C., is not poisonous. Römer and Preschel were engaged in experiments to find whether the new form of phosphorus might not be used in matches instead of white phosphorus. They found that a mixture of chlorate of potash, sulphuret of antimony, and amorphous phosphorus would take fire readily through friction on a rough body, but the same result followed which Kammerer had experienced with his first mixture. The mass exploded with a violence that sent burning bits of the stuff hissing all over the room. About 1850 the German chemist Böttger introduced a novelty which marked the beginning of a new era in the match manufacture. He made the substance of the head of the match of a mixture of chlorate of potash and sulphuret of antimony, using gum to bind them, and prepared a special friction surface consisting of a coating that contained amorphous phosphorus. When the head of the match was drawn over this substance bits of the amorphous phosphorus were kindled here and there by the friction, which ignited parts of the match-head, producing the explosion of the whole mixture.

The "Swedish safety matches" were made in many German shops from Böttger's recipes about 1850, but they could not compete with the phosphorus matches. People had become accustomed to the last; they were easily lighted, and if the sandpaper was lost, fire could be got by drawing them on the wall or the trousers; while with the new matches one had always to carry his rough card phosphorized with amorphous phosphorus, without which his match was useless. The great value of the German discovery, however, became known abroad about 1860, when the Swedish engineer Lundstrom founded the famous factory in Jönköping. The material of the match-head and the friction surface remained as before, but the Swedes devised a practicable method of boxing, putting the matches in the little convenient slide-boxes, and the chief hindrance to the spread of the invention was removed. The "Swedish matches," as they are now generally called, do not light of themselves so easily as the phosphorus matches, and are therefore safer; and they are, further, unpoisonous. It is therefore no wonder that the "Swedes" have enjoyed a triumphal march through the world, have found a home in Europe and America, and have even made their way into dark Africa. During its most prosperous period, the Jön-

köping factory produced annually four million marks' worth of matches. Rivals soon rose to it in different parts of the world, and several shops in Germany are sending out excellent Böttger safety matches in Swedish dress. They have so far naturalized themselves as to make the condition of the phosphorus match trade a hard one, and in some states the prohibition of the use of the poisonous white phosphorus in matches has been contemplated.

Still the match has not yet reached its highest stage of perfection. A third period of development looms before it. The safety matches can still be lighted only on the prepared surface of the box. An unpoisonous match which will light as readily as a phosphorus match is not yet found.

Not less important than the chemical constitution is the mechanical preparation of the little fire-bearers. The times have passed when a man could make matches profitably with a simple apparatus at home or in a little shop. Machines have gained the victory over hand labor in this field, and they only are competent to turn out the thousands of thousands of sticks that are burned yearly. The favorite wood for matches is the poplar; but as this can not supply all the demand, pine and fir woods are also used. In the early days of the manufacture, the work of cutting the blocks and forming the sticks was performed by hand; but now the machines are so perfected that a single one can turn out as many as 6,000,000 sticks in a day of ten hours.

The ordinary cut stick is not adapted to matches the heads of which contain no sulphur, and the Swedish matches are prepared by a new method, in which the sticks are obtained by a peeling process. The logs are barked and sawed into blocks about eighteen inches long. These are steamed, then drawn out of the tubs and placed while still hot into the peeling machine, where they are turned upon a pivot and cut by a sharp knife into a continuous band of the right thickness, which is also cut into strips as broad as the length of a match. One of these machines, of only two horse power, operated by a man, can in one working day turn out 4,000 square metres of shavings, from which 15,000,000 matches may be made. The narrow ribbons of wood next go into a machine the operation of which is something like that of a common straw chopper. By a simple mechanism from fifty to seventy thicknesses of the ribbons are pushed slowly forward under a sharp knife, which cuts them into sticks of the desired thickness. These fall upon an endless belt and are carried by it into the drying room. There are machines which, worked by a man and a boy, will turn out 28,000,000 sticks a day. The boxes for the Swedish matches are likewise made by the aid of machines, a description of which involves too many technicalities to

be given here; so we only mention a few facts concerning their performance.

The first machine prepares daily 3,000 square metres of board, out of which 200,000 boxes can be made. The second machine cuts up the board into strips affording material for between 300,000 and 400,000 boxes. Another machine sticks these boxes together. The outside box is held together with blue paper. This paper is introduced in endless strips about fifty-six centimetres broad from a roller adjusted sidewise to it; and the cutting, turning, and parting are all done automatically. With one girl to serve it the machine completes daily 36,000 outer boxes. Another machine makes the drawers of the boxes, turning out 25,000 of them in a ten hours' day. Next the boxes are smeared on the narrow sides with the preparation on which the matches are rubbed. A machine does this for between 120,000 and 150,000 boxes a day, more neatly and correctly than can be done by a man's hand. Finally, there is the machine for pasting on the name of the firm, which tickets from 40,000 to 50,000 boxes a day, using less paste in the operation than a workman would. If we reflect now that there are thousands of these machines in different parts of the world, we may be able to comprehend the importance which the match industry has reached in our time.

We return to our sticks, which we left in the drying room, and which are yet to be furnished with the inflammable heads. Before this is done, the tips of the sticks are smeared with some substance that will take fire readily—sulphur, paraffin, or stearin. For this purpose they are dipped in the matter while it is warm. It was discovered at the beginning of the manufacture that no progress could be made if single matches were to be dipped by hand, and frames were devised for the purpose; they were made of thin boards, in which rows of parallel grooves were cut. The sticks were laid in these grooves, and they being short, the matches projected from them. The boards, having been filled up, are tightly packed in larger frames, and the whole, containing hundreds of thousands of matches, is immersed in the bath. The sticks were formerly deposited in the grooves by girls, who became so dexterous in the business that they could handle as many as 200,000 of the splinters in a working day. More recently machines have been substituted for this tedious labor, with which 1,500,000 matches can be handled in a day. But no one has succeeded in inventing a machine for coating the heads with the inflammable matter. That has still to be done by hand.

When the heads are fixed, the matches are returned to the drying room, where they remain till they have parted with all their moisture; then they are taken out of the frames, laid together, and packed in boxes. This part of the work, which is

attended with danger of fire, was likewise till only a short time ago performed by hand; but machines have now been devised which take the matches from the opened frames and drop them all in order into large cases, from which they are then repacked in small boxes. One of these machines of the latest construction is capable of extracting from the frames from two to three millions of the sticks a day, with far less danger of fire than when the work is done by men.

Still more recently the Swedish Lundgren, who is famous for his box-making machines, has devised another machine, which fills the boxes and delivers them closed. Nothing more needs to be done than to fill the receiver of the machine with matches and boxes, and to draw from it 25,000 well-filled boxes in a working day.

Thus we see that the little match, which passes away so quickly, has a famous history, and is really one of the most wonderful achievements of the human race. An immense amount of most sagacious ingenuity is concealed in it. The negro is right when, seeing light and fire spurt out as he looks at the curious thing, he cries out that "it is an enchantment," for the little piece of wood certainly surpasses the most marvelous art of the old magicians. —*Translated for The Popular Science Monthly from Die Gartenlaube.*

THE Challenger Report, recording the work of the greatest scientific voyage ever undertaken, is now completed, in fifty large volumes containing 29,500 pages of letterpress, with 3,000 plates and maps, and innumerable blocks in the text. The Challenger Expedition left England in December, 1872, charged with the scientific exploration of the physical, chemical, geological, and biological conditions of the great ocean basins, with Captain George S. Nares as naval commander, and Prof. Wyville Thomson and five other gentlemen as the scientific corps. A very complete study was made of the Atlantic Ocean, which was crossed and recrossed in many different directions. From Cape Town the Challenger proceeded to Australia by a southerly course, and was the first steam vessel to cross the Antarctic Circle. She then passed through the western Pacific and its island groups to Hong Kong and Japan, crossed to the middle of the Pacific in 40° north and sailed south to 40° south; then visited Juan Fernandez and Valparaiso; passed through the Strait of Magellan; and returned along the central line of the Atlantic to England in May, 1876. More than five hundred deep-sea soundings were made, with deep-sea dredge and trawl. Besides the vast collection of marine animals, specimens of water from different depths, and of the deposit in the sea-bed were obtained. Tow-nettings for the collection of surface-living organisms were taken continually, magnetic observations whenever it was possible, and meteorological and surface temperatures every two hours. The results of the exploration have furnished food for several years' study by many naturalists besides those concerned in the preparation of the report.

EDWARD HITCHCOCK.

BORN at Deerfield, Mass., May 23, 1793; died at Amherst, Mass., February 27, 1864.

The first of this family emigrated to this country in 1635, coming probably from Warwickshire in England. He was one of the original members of the New Haven, Conn., Colony. Two or three generations of the family resided in New Haven; the fourth in the line emigrated to western Massachusetts, and was an officer in the Revolutionary War. His son, Justin, the father of Edward, was a soldier in the army of General Gates when Burgoyne's army was captured. Justin married one of the Hoyts, who was descended from the sufferers at Deerfield at the French-Indian raid of 1704. He settled at Deerfield, and was a hatter. Becoming embarrassed financially by obligations incurred in the continental currency, he suffered from poverty all his life, and was unable to give his children more education than was afforded by the common school and the local academy. Edward was therefore compelled to educate himself, and that under the drawback of ill health, caused by overwork and carelessness. Six particulars may be mentioned, going to show that by improving his opportunities he was well educated in many respects: 1. For several years he was a leading member of a debating society. This afforded the opportunity to practice extempore speaking, composition, and acquire facility in philosophical reasoning. A few short poems showed that he essayed the higher type of composition. One of these was a tragedy entitled The Downfall of Bonaparte, written at the age of twenty-two, just after the battle of Waterloo, and acted by himself and friends before the people of the village. 2. For four years—from twenty-two to twenty-six—he was the principal of the academy in his native town. As there were always in this school a number who were fitting for college, he found it necessary to review all his classical studies—not once merely, but several times. The same was true of scientific studies also, so that quite a large number of subjects were gone over very thoroughly, and the details were fixed in his memory. It was a better discipline than if he had simply taken these studies as a college student. The academy owned a very good philosophical apparatus, and young Hitchcock prepared a number of lectures on physics, which were delivered with experiments both before his classes and in the evening to people of the village. 3. Perhaps the best mental discipline came from the use of the astronomical instruments belonging to the academy. He observed first the comet of 1811. From September 7th to December 17th, during the presence of the celestial visitor, he noted the distance of the

comet from various stars, determined the latitude and longitude by lunar distances and eclipses of the sun and moon, occurring about the same time, and the variation of the magnetic needle. Several months of study were required to reduce these observations; and as tables were wanting, he was compelled to calculate elements that the modern astronomer finds ready to his hand. The results of this work were published by the American Academy of Arts and Sciences in a paper by General Epaphras Hoyt, the conclusions of the uncle and nephew being combined in a longitude determination. 4. In making these calculations use was made of the Nautical Almanac, then published by Edmund M. Blunt, of New York (reprinted from the standard English publication). Errors would hardly be looked for in such a work, but beneath the opening page for every month was this sentence: "Ten dollars will be paid on the discovery of an error in the figures." Young Hitchcock soon discovered a long list of errors, both in the figures and the text, and sent it to Mr. Blunt, who answered evasively. The list was then published in the American Monthly Magazine, which called out Mr. Blunt in a statement commencing, "Noticing an attack on my Nautical Almanac from one Edward Hitchcock, a few remarks only are necessary to explain the man's drift." He represented the errors as occurring in a part of the work used chiefly by astronomers, and added, "I would rather ten errors should escape me *there* than one by which the mariner should be deceived." Before this answer had been seen, Hitchcock had forwarded to the magazine a list of twenty errors in the tables of lunar distances, which were serious, because of their magnitude and their use by sailors. Six months later another list of thirty-five errors from these almanacs for 1815, 1816, 1817, and 1818 made its appearance. This led Mr. Blunt to employ a mathematician to recalculate the almanac for 1819, and in his preface to state that "it will afford much satisfaction and promote commercial advantages if, on discovery of an error in any nautical work, publicity should immediately be made." A copy was sent to Hitchcock, who soon made out a list of thirty-five errors, and forwarded them to the magazine. Mr. Blunt did not send the pecuniary reward promised, but published the statement that "the communication of Mr. Hitchcock deserves notice, and he is entitled to much credit for his perseverance." It was a great triumph for a young man to sustain himself against these standard astronomical tables. The most rigid accuracy was indispensable, and the discipline fully equal to that acquired by years of scholastic training. 5. A related discipline came from the publication of a Country Almanac from 1814 to 1818, whose calculations were original. Here also accuracy was essential to success. No complaint was ever made, except in the assignment of Easter to an

unusual date. Both clergymen and people denounced the almanac because of this supposed misstatement. Defense was made that the ordinary rules for determining this festival were useless for that year, as it was a peculiar case, occurring only once in several hundred years. Soon afterward the bishop of the diocese issued a circular sustaining the almanac. 6. Classical training came in connection with teaching. First came the ordinary labor of making translations and grammatical construction. Then he kept a note-book for putting down the most striking sentiments of an author, such as would answer for mottoes and quotations. To obtain the choicest sentiments he carefully looked up all the references made from rare authors. Thus he became familiar with the best thoughts of the classical authors, and by fixing them in his memory obtained a fair substitute for the more extended college training.

During his connection with Deerfield Academy, Hitchcock became interested in botany and mineralogy, through the influence of Prof. Amos Eaton. With two associates, the list of plants and minerals of the neighborhood was soon made exhaustive. He had correspondence with the elder Prof. Silliman, of Yale College, respecting difficult questions, and the two maintained for each other a lifelong friendship. It was probably this correspondence which led Hitchcock to join the newly opened theological department at New Haven. He furnished contributions to the first volume of Silliman's American Journal of Science and Art, and to many later issues. In all, his name is prefixed to fifty-two papers, notices, and reviews on topics relating to geology, mineralogy, ichnology, surface geology, physics, meteorology, and botany, in this journal.

Hitchcock chose the ministry for his profession. He was settled as a pastor over the Congregational Church in Conway, Mass., from 1821 to 1825. While in this office he studied natural history to some extent, for the benefit of his health. It was at this time that he discovered and described that small but widely distributed fern, *Botrychium simplex*. In 1825 he was appointed Professor of Chemistry and Natural History in Amherst College. Twenty years afterward he became president of the same institution, and continued in the office for nearly ten years. For the remainder of his life—nearly ten years—he taught geology and natural theology in the same institution.

Like scientific men of his time, Dr. Hitchcock was familiar with several departments of learning—being an author, educator, theologian, and explorer. His career as a geologist is the best known. Starting as a student of the rocks of the Connecticut Valley, his home, he is soon found at both extremities of the State —at Martha's Vineyard and Berkshire County. With larger op-

portunities for travel, he was impressed with the importance of interesting legislatures in geological surveys, and he took measures to enlist the government of Massachusetts in such work. With this aim in mind he published a lengthy review of Olmsted's survey of North Carolina in the American Journal of Science, in 1828. Near the close he says: "We wish now to ask the intelligent legislator whether such a development of internal resources as this report exhibits does not amply remunerate the State of North Carolina for the comparatively trifling expense of this survey; and whether so great success . . . does not strongly recommend that this example be followed by other States of the Union."

As the result of this and other efforts, the State of Massachusetts commissioned him to make a geological survey of her territory in 1830. Three years were spent in the explorations, and the work was of such a high character that other States were induced to follow the example of Massachusetts, and similar surveys were organized in Tennessee, Maryland, New Jersey, New York, Virginia, Maine, Rhode Island, New Hampshire, Connecticut, Pennsylvania, Ohio, Delaware, Michigan, Indiana, Kentucky, and Georgia. The State of New York sought his advice in the organization of a survey, and followed his suggestions, particularly in the division of the territory into four parts, and appointed him as the geologist of the first district. He entered upon the work, but after a few days of labor he found that he must necessarily be separated from his family, much to his disinclination. He also conceived the idea of urging a more thorough survey of his own State; hence he resigned his commission and returned home. The effort for a resurvey of Massachusetts was successful, and he was recommissioned to do the work. The results appeared in 1841 and 1844—the first a quarto report and the last the geological coloration of a map based upon Borden's Trigonometrical Survey.

Independently of the survey came the discovery of fossil footmarks. As far back as 1800 Pliny Moody had observed trifid markings upon sandstone which he called the tracks of birds. In 1835 Mr. W. W. Draper, of Greenfield, Mass., noticed similar impressions, and drew the same conclusions. Mr. Draper remarked upon them to Dexter Marsh and Colonel William Wilson, who in turn consulted Dr. James Deane, who wrote to Professors Silliman and Hitchcock. All agreed to refer the investigation to Prof. Hitchcock, who propounded the fundamental principles of ichnology in the January number of the American Journal of Sciences for 1836. The announcement was not favorably received by many geologists, while the general public gave expression to their views by the employment of ridicule. The subject was re-

ferred to a committee of the American Association of Geologists, consisting of H. D. Rogers, L. Vanuxem, R. C. Taylor, E. Emmons, and T. A. Conrad, in order, if possible, to produce a unanimity of opinion. Those who had most earnestly opposed the new doctrine were upon the committee, but all were convinced; as their report, issued in 1841, states, "From a comparative examination of the facts on both sides, your committee unanimously believe that the evidence entirely favors the views of Prof. Hitchcock, and should regret that a difference had existed, if they did not feel assured it would lead to greater stability of opinion."

The publications upon the subject of these triassic footmarks by Prof. Hitchcock have been quite numerous. The most important were that in the final report upon the geology of Massachusetts in 1841, a paper in the Transactions of the American Academy of Arts and Sciences in 1848, in the Ichnology of New England, published by the State of Massachusetts in 1859 and its supplement in 1865. The total number of species described, as finally revised, amounted to one hundred and fifty. They were referred to several groups: a few marsupialoids, thick and narrow-toed birds, ornithoid lizards or batrachians, lizards, batrachians, chelonians, fish, crustacea, myriapods, insects, and worms. At first the trifid impressions were referred to birds; and it was considered a remarkable confirmation of this view that in 1838 or 1839 there should have been found in New Zealand the bones of true birds having the same dimensions as the largest *Brontozoum*. Prof. Owen has stated that his belief in the ornithic character of the *Deinornis* was strongly fortified by the fact of the existence of the *Brontozoum*. Very soon after the earliest publications about these ornithichnites specimens were exhumed which became very puzzling because of the presence of quadrupedal characters. It became very clear that there must be an intermediate class of beings between birds and reptiles, and accordingly this conclusion was embodied in the assignment of a large number of these *Ichnozoa* to the designation of "ornithoid lizards or batrachians." As time has progressed the order of *Deinosaur* has been proposed, to include such animals as have been made known to us by their bones; and now it is doubtful whether any of the impressions were made by birds. Prof. O. C. Marsh has obtained entire skeletons of *Deinosaurs* from the Connecticut sandstones, which he calls *Anchisaurus*. They seem to be allied to the *Plesiornis* rather than the *Anomœpus* or *Brontozoum* of Hitchcock.

The specimens from which the opinions and descriptions of the ichnology were derived are preserved in the Hitchcock Ichnological Cabinet at Amherst College, and completely fill a room one hundred by forty feet, besides two smaller apartments. The number of distinct impressions studied and labeled exceeds twenty

thousand. It is likely that some of the suggestions of the Ichnology may not be verified. It would be strange if the following thirty years of discovery should not enable paleontologists to declare positively whether the *Batrachoides* impressions are really the mud nests of tadpoles, or whether the "insects" are properly larval or adult hexapods, or simply crustacea, as urged by Dana and Agassiz.

In 1857 Prof. Hitchcock accepted the appointment of State Geologist of Vermont. Though the appropriation was very small the work was energetically prosecuted, and conclusions presented in five years' time in two quarto volumes of nearly one thousand pages. Not many speculations were indulged in, though opportunity was afforded for propounding new and startling theories of the metamorphosis of rocks. The report was issued just at the time when Barrande had discharged his artillery at the opponents of the Taconic system, and compelled American paleontologists to assign the *Olenellus* to the primordial zone instead of the Hudson River slates. The report had been written to accord with the American view, but the authors were enabled to omit everything that did not illustrate the reference of the slates to the Cambrian terrane. The Vermont report suggested two general principles which have been of great service in the further discussion of the nature of metamorphism and the age of the New England rocks. The first point relates to the distortion and alteration of pebbles in conglomerates. As far back as 1832 Prof. Hitchcock had noticed the singular alterations in the shapes of pebbles constituting conglomerates in Rhode Island. Not till 1861 was he able to present satisfactory considerations concerning their distortion and alteration. He argued that pressure and metamorphism could totally obliterate the shapes of pebbly constituents and convert them into crystalline schists. Very few of his contemporaries followed him in this generalization. The large geological manuals of Dana and Le Conte conspicuously avoided any mention of this view. To-day the skilled petrographers of the country unanimously indorse the doctrine of the distortion and alteration of the fragmental constituents of sediments.

So long as our paleontologists referred the Cambrian fossils to the Hudson River group, their associates, as represented by Sir William E. Logan, insisted that the quartzite in western Vermont overlaid the slates, and was of Medina age. Logan also claimed a synclinal structure for the Green Mountains. Before accepting any conclusion as to their structure, Prof. Hitchcock directed that this mountain range should be carefully studied stratigraphically. A dozen sections were made at equal distances apart across the State, and it was discovered that the structure was anticlinal when not monoclinal; and hence comes the certainty

that the axis of the Green Mountain chain is older than lower Cambrian. The latest workers in this field accept this conclusion.

Perhaps the favorite subject of Prof. Hitchcock was the study of the "Drift." He began to study the ice-marks even before the discovery of the footprints, and soon found himself far beyond the comprehension of his literary and scientific associates. Neither the iceberg nor glacier theory was original with him; but no one up to the time of his death had published so much upon the subject. His views are developed in the treatise on Surface Geology published by the Smithsonian Institution in 1857. His general theory refers the phenomena to both icebergs and glaciers; and their setting forth was generically like the most recent deliverances of Sir William Dawson, who acknowledges the presence of glaciers upon the mountains from which the icebergs were derived that flooded the submerged valleys. His papers are of special interest concerning river terraces, local glaciers in western New England, trains of bowlders, and frozen deposits of drift gravel. It is an interesting fact that he argued against the admissibility of Agassiz's glacial theory because of the absence of a grand terminal moraine at the outer margin of the ice sheet. It was less than five years after his death that geologists began to appreciate the true significance of the backbone of Long Island—that it was part of a gigantic moraine more than a thousand miles long. It is easy to see where Hitchcock would have stood had these facts been known in his day.

The first written suggestion in regard to the formation of the American Association of Geologists came from Prof. Hitchcock, and he was chosen its first president in 1840. This was the parent of the later organization known as the American Association for the Advancement of Science. He was present at nearly every meeting of both organizations until the gap in the later history induced by the war.

As President of Amherst College he was called upon to exercise unwonted judgment. The institution had almost broken down because of heavy indebtedness. The historian of the college declares that the institution was saved from destruction by the skill and wisdom of President Hitchcock. As an instructor and guide no one was more loved and honored. The number of students doubled during his administration. It was while he was president that his Religion of Geology appeared, in which he expounded the applications of science to theology. Most of the positions there maintained are accepted by the advanced Christian thinkers of to-day. The work appeared before the advent of Darwinism, but its principle was discussed as creation by law. While not accepting any development hypothesis, Prof. Hitchcock took

pains to insist that its adoption would not be at variance with any fundamental principle of theology. During his lifetime the doctrine of creation was the prevalent fashion of thought, just as now everybody is an evolutionist, and as in the Mesozoic age every vertebrate animal assumed some reptilian feature.

Prof. Hitchcock devoted much thought to the relations between science and theology. He believed that his suggestions—original with him—would tend to bring together truths often divorced, but which only man puts asunder. The following are topics upon which he made important suggestions: 1. Proof of the general benevolence of God from geology. 2. Evidence from the same, of special divine interpositions in Nature. 3. Evidence from the same, of special providence. 4. Mode of answering objections to the doctrine of the resurrection of the body by the nature of bodily identity. 5. The religious bearing of man's creation. 6. The adaptedness of the world for the redemptive work. 7. The Mosaic days properly interpreted by symbolism. These and related truths were taught by him to his classes under the title of natural theology. Through his efforts the chair of Geology and Natural Theology was endowed in Amherst College, with the understanding that the science should always be taught from a religious standpoint.

A list of Prof. Hitchcock's published writings shows a total of twenty-six distinct volumes, thirty-five separate pamphlets, ninety-four papers in periodicals, and eighty newspaper articles—a total of 8,453 pages, with 256 plates and 1,134 woodcuts. Half of these were scientific papers; of the others, most were religious books, essays, sermons, and tracts. He published also biographies, reviews, poetry, and temperance documents.

In 1821 Mr. Hitchcock married Miss Orra White, daughter of Jarib White, of Amherst, Mass., and they lived together for forty-two years. Mrs. Hitchcock was an artist, and prepared many of the illustrations of her husband's reports. Six of their children, two sons and four daughters, reached maturity. The oldest son is the Professor of Hygiene and Physical Education at Amherst College; the youngest is the Professor of Geology at Dartmouth College. Three of the daughters were married—the first to Rev. Dr. H. M. Storrs, lately of Orange, N. J.; the second to G. B. Putnam, of the Franklin Grammar School, Boston, Mass.; the third to the late Rev. C. M. Terry, of Minneapolis, Minn. The oldest daughter is known as an amateur botanist, residing at Hanover, N. H.

EDITOR'S TABLE.

THE PROSPECTS OF SOCIALISM.

THE result of the recent elections in Great Britain has given no little discouragement to the hopes of those who were looking to see a great increase in the socialistic element in the British House of Commons. It is clear that up to this date the British public is more interested in the definite and limited questions of so-called "practical politics" than in the vague and general schemes put forward for the improvement of the world on the lines of socialism. What the British public feels in regard to this matter is felt, we believe, by the great mass of every advanced community in the present day. When socialistic writers or orators descant on the evils of the existing condition of things, striking as they frequently do a true and generous note, the sympathy of many goes out to them; but it is a different thing when society is asked to commit its legislation to the hands of these eloquent declaimers. Even those who acknowledge that such men *feel* right, entertain very often grave doubts as to whether they *see* right—whether their views are practical, whether they have truly forecasted the results of the changes they would introduce, and whether their benevolent efforts, if power were intrusted to them, might not prove the ruin rather than the salvation of the state.

It would be a great mistake to suppose that all who can not see their way to support socialistic schemes, and who can not even share to the full socialistic sentiments, are either insensible to the evils, such as they are, of our social state, or unwilling to do all in their power to have those evils remedied. There is abroad in the world to-day a very general desire to see things made right and fair for the average of mankind and for all men, to have the general conditions of life improved, to have an abatement, on the one hand, of the senseless luxury of the wealthy class, and, on the other hand, a dignifying of the lot of the ordinary citizen. Things are to-day perceptibly moving in the direction of giving better conditions to the average man; but they might move more quickly if the average man would only stand more firmly on his rights, and prosecute them in a more intelligent manner. Whenever the state grants a public franchise, then is the time to make the best bargain possible for the citizens at large. But on what does the possibility of protecting the rights of the citizen in such matters depend? Manifestly, on there being in our legislative bodies men who will not traffic with rich corporations in the citizens' rights. Then on what does the presence of such men in the legislature depend? Now we come to it: the citizen has the composition of the legislature in his own hands, and it depends on him whether the making of the laws shall be intrusted to honorable or to dishonorable, to trustworthy or untrustworthy, men. One of two things: either representative institutions are a mockery and a fraud, or the mass of the citizens have it now in their power to protect their own interests so far as the whole public life of the state is concerned. How they have betrayed their own rights and privileges into the hands of tricksters, gulled by some party cry or swayed

by yet baser motives, is the story of nineteenth-century politics.

In spite, however, of such self-betrayal, things have improved even for the self-betrayed—not, of course, as they might have done, but still they have improved. If we compare the beauty of our modern cities and the multiplied conveniencies and decencies of modern life with the condition of things existing fifty years ago, we shall see that the average citizen lives in a world that is a much pleasanter and more desirable abode than that in which his grandfather's years were passed. At very small expense he can do a hundred things and share a hundred pleasures and advantages that either were totally inaccessible to his grandfather, or were only to be obtained at almost prohibitive cost. Whether the man of to-day is on that account happier than was his ancestor is another question; all we maintain is that he has at least the means of enjoyment and self-improvement placed within his reach in much more liberal measure. It is needless to say that all such changes for the better have been due, in the first place, to the great advance that has been made during the present century in scientific knowledge, and, in the second, to a certain enlargement of view and increased liberality of sentiment that have been the accompaniments of that advance. To say that the benefits of scientific discovery and invention have been monopolized by the rich would be to fly in the face of the most obvious facts. To the rich have doubtless been opened up new channels for extravagant expenditure; but the most substantial benefits of increased knowledge have been reaped by those of average means and by the poor.

The true road to that improved condition of human society which socialists are so desirous of bringing about lies, we have always held, through a heightened and strengthened individualism. One great advantage of approaching the problem from this side is that individualism does not imply a call for any form of state action. It means an awakened sense of individual worth, a consciousness of individual rights, the exercise of individual self-control, the elevation of individual aims and ambitions. The socialist wants to make men other than they now are by legislation. The individualist says that men might be other than they now are without legislation; at the same time he makes no objection to any legislation which springs from an actual necessity of the body politic, and which, without taking a needlessly wide sweep, holds out a remedy for a specific evil. He objects on principle to legislation which, for example, undertakes to repress drunkenness by forcing all men to be total abstainers. The sweep here is too wide, the law undertaking, not only to repress a specific evil, but to interfere on a vast scale with the liberties of persons who have in no way merited such interference. The cardinal doctrine of individualism is that each man is primarily responsible for making the best conditions of life he can for himself, and that he is the better for being held to this responsibility. Some writers declaim on the injustice of demanding a degree of virtue in the poor which is never practiced by the rich. It is not a case of demand, however; it is a case of counsel. If there are practices injurious to health, if there are useless modes of expenditure and degrading forms of amusement, he surely is neither an enemy nor an unsympathizing critic of the laboring classes who would urge them to avoid these things, and, by doing so, to stand forth in a nobler than any

merely political liberty—in the liberty of men masters of themselves and already the partakers of a far higher life than that of the self-pampering sons and daughters of luxury. The more we reflect upon it, the more we are impressed with the amount of good which might be done in the world, independently of any and all legislation, simply by the substitution of higher aims for the lower ones which now rule so largely all classes of society. How many pass their lives in a miserable attempt to imitate the bad taste and generally foolish proceedings of the class next above them in point of means! If to-day Shoddy is king, it is simply because men and women are silly enough to make him so; not because there is anything in our laws to authorize or constitute his royalty. We can dethrone him whenever we like, without passing even the smallest municipal by-law, by simply resolving to throw off the yoke of false pretense, and live our lives in a simple, honest, and reasonable manner, studying what is excellent and not what is fashionable, the things that make for inward peace and outward dignity, rather than those which make for outward show and inward unrest.

It is truly the folly of mankind that is chiefly responsible for the evils which have called socialist agitation into existence; and it is doubtless a deep-lying instinct that such is the case which causes society as a whole to look coldly upon proposed socialistic remedies. It is desirable that discussion of this subject should be as free as possible, and our belief is that the more the subject is discussed the more clearly it will appear that a higher individualism is the key to the solution of our social problems. What the world wants is an extension of those liberties which a man can create for himself, rather than of the privileges and protections which are created by statute. The highest service, therefore, which any one can render to society is to awaken men in general to those possibilities of life which simple individual initiative and determination can realize; for thus, more than in any other way, would the unjust power of capital be broken, and the way be opened for the healthiest and happiest development of the social organism.

SHAM EDUCATION.

One of the leading writers of fiction of the present day has, in a quite recent work, attempted to set forth the miserable results of the pretentious modes of life and, above all, the pretentious systems of education which, according to his view, are characteristic of the time. The scene of his story is laid in England in the year of the Queen's Jubilee (1887), and the local color, as the expression is, is strongly English; nevertheless, there is much in the descriptions given and the lessons drawn which is capable of application far beyond the limits of the society the novelist had in view. He introduces us to a young woman who is overstraining all the resources of a very indifferent constitution in a desperate struggle to prepare for the matriculation examination of the London University, but whose mind is meantime in even a more feeble condition than her body, her judgment in practical matters wholly unexercised, her temper and disposition a compound of vanity, jealousy, and spite. We read of another who, having passed through an expensive course at schools reputed to be of a very superior grade, had emerged with an equipment of undigested knowledge which simply developed in her a morbid self-consciousness and a futile ambition to shine in some higher sphere than

that in which her lot was cast. So far did the spirit of rebellion against circumstances carry this young woman that she abandoned herself to a young Oxford graduate of good birth who charmed and dazzled her by the superiority of his culture and bearing. We get a glimpse of another family in which a young wife and mother, also brought up in a pretentious fashion, neglects every duty of her position and leads her husband such a life that, taking his child with him, he turns his back upon her, leaving her, with such an allowance as he can afford, to her own devices.

It may be said, and has been said, that this author draws with too dark a pencil; but this need not prevent us from discerning the truth to which he calls attention. We learn from his pages, not that a "little knowledge is a dangerous thing," but that superficial knowledge, all unconscious of its superficiality, is a dangerous thing. We learn that a mind clogged with undigested information may lose the power of spontaneous judgment and become the sport of accidental influences. We learn that education may be so bestowed as to minister to vanity rather than to self-respect, to a spirit of reckless and selfish ambition rather than to a sense of responsibility, to habits of weak self-indulgence rather than to any strengthening of the moral powers. The question may then be asked, How are these dangers to be avoided? We answer, by making the building up of character the constant aim of educational work, and the guiding principle in the selection of courses of study. The forcing of uncongenial studies upon unwilling minds is a process that can not be too strongly deprecated, inasmuch as it inevitably tends to the creation of an unnatural atmosphere for the individual, to the confusing of his intellectual perceptions and the destruction of that sense for reality which it is above all things important to preserve. We are strongly of opinion that very serious dangers of the nature already indicated will attend our systems of education until the secret has been found of making all education contribute not less to the right development of character than to the sharpening of the intellectual faculties. That the thing can be done we have not the shadow of a doubt; and to say that it can be done is to say that it must be done.

The author to whom we have referred seems to be of the opinion that an unwise education shows its worst results upon the female sex. In this we think he is right. Contact with the world of which most men have early experience tends to correct the errors, repair the omissions, and cancel the superfluities of their scholastic training; whereas women whose minds have been injured by their school training do not, to anything like an equal extent, enjoy the means of throwing off the faults they have imbibed. It is, therefore, of special importance that young women should not be made the victims of false systems of education. Their intellectual food should be of the purest and most nutritious, so that the effects of their education may be seen, not in a blaze of evanescent accomplishments, but in a steady glow of rational thought and generous emotion. We have not yet learned to make the best of life, and many are the evils we suffer in consequence; but if once it can sink into the consciousness of the community that education for both sexes should be regarded not as a preparation for a career of mere self-seeking, but as an introduction to all the possibilities of higher mental and moral life, a most important step in the progress of the race will have been won.

LITERARY NOTICES.

HANDBOOK OF PSYCHOLOGY. SENSES AND INTELLECT. 1890. Pp. 343. $1.80. HANDBOOK OF PSYCHOLOGY. FEELING AND WILL. 1894. Pp. 339. $2. ELEMENTS OF PSYCHOLOGY. 1892. Pp. $1.50. By JAMES MARK BALDWIN, Stuart Professor of Psychology in Princeton University. New York: Henry Holt & Co.

PROF. BALDWIN expresses the hope in the preface to *Senses and Intellect* that no book upon psychology will hereafter satisfy the requirements of higher education for more than a generation. He says that the philosophical conception of the sphere and function of psychology now prevalent is widely different from that of twenty years ago, when many of the works were written which are yet used as introduction and strong support to the philosophy taught in the universities—"the new conception, namely, that psychology is a science of fact, its questions are questions of fact, and that the treatment of hypotheses must be as rigorous and critical as competent scientists are accustomed to demand in other departments of research." It is no new complaint that outworn and effete ideas continue to drag through school books long after they have been exploded in the world of living science. The hypothesis of caloric was still taught to the young when the doctrine of the correlation and conservation of forces had become firmly established in the minds of scientific men. The old dual chemistry held on in education, though all out of harmony with well-known facts, and though discussion and speculation were rife concerning the chemical constitution of bodies. When at last the compilers of text-books could no longer ignore the new state of things and seriously undertook to keep their works abreast of discovery, the advance was so rapid that new books and new editions were needed every eight or ten years at most. It is the same now in psychology. The accumulation of facts in this field and the activity of speculation about them are quite as remarkable. Since the appearance of Prof. Bain's great work on the Senses and Intellect forty years ago, wherein the physical basis of mind for the first time received adequate treatment in a book of instruction, there has been a most productive activity of observation, experiment, inquiry, and speculation, and several new divisions of psychological science have taken distinct form. Not to speak of psychiatry, or abnormal psychology, we have psychometry, psychophysics, and neurology pursued independently and with promising results. An excellent feature also is his "Further Problems for Study," given at the end of each chapter, indicating partially unexplored fields in which students may engage themselves in an original way. It is thus that tastes are strengthened in early life, that character is formed, and philosophers are made. When, therefore, the attempt is made to give such a presentation of the science as will meet the needs of our higher education and of an intelligent reading public, great judgment is required in choosing and rejecting material lest the work overrun all practical bounds, like that of Prof. James's, or for the most part omit the discussion of unsettled questions, like Sully's. A judicial quality is also needed to enable the author to deal fairly and in proper proportion with all branches of his vast subject. Prof. Baldwin's handbook may be commended in both these directions. He not only gives the facts, but he discusses theories and presents the important aspects of disputed questions. He does not burden the text with difficult points that are unsettled, but puts them in smaller print for students who like to know all sides and to go to the bottom of the case.

The first volume of the handbook, *Senses and Intellect*, opens with a short introduction, of which Chapter I is on the nature of psychology, Chapter II on method, and Chapter III on classification. Part I, containing two chapters, deals with the general characteristics of consciousness and attention. Part II, on the intellect, has nine chapters, and the book concludes with a short chapter on The Rational Function.

Oddly enough, we have to wait till the second volume, *On Feeling and Will*, before we are given an account of the structure and functions of the nervous system. Why this is so does not appear, although it is evidently by design. Prof. Baldwin states the truth about the connection between mind and body plainly enough, but does not emphasize it or enlarge upon it. Perhaps he had

some jealousy of physiology, for he says in the preface to the second edition of *Senses and Intellect* that the object of the work was "largely, to demonstrate the independence of psychology," and a parade of pictures from the physiologies at the very outset might prejudice the case. His metaphysical training would be apt to generate such a feeling. However, in *The Emotions and Will* full consideration is given to the physiological side of the subject in three chapters: Chapter I, The Nervous System; Chapter II, The Nervous System and Consciousness; Chapter III, Nature and Divisions of Sensibility. Four chapters follow upon the Feelings and four upon the Emotions before we reach the division of the Will, to which a hundred pages are given. The headings of the chapters and of the paragraphs look very attractive, and we have dipped into the work sufficiently to perceive the thoroughness of Prof. Baldwin's preparation for his undertaking, his deep earnestness and abounding enthusiasm. He must have looked upon his first venture as an experiment, and we can imagine his delight when within a year of its publication the unexpected demand was made upon him for a new edition of *Senses and Intellect*. This alone is a proof of its adaptation to present needs, while the interest aroused by it in the author's "philosophical point of departure" is another guarantee of its quality. Still another, were it needed, may be found in the request made by a number of teachers of psychology in the universities that a single, compact volume should be made of the larger work, such as could be furnished at reasonable cost. This request has been complied with in the *Elements of Psychology*, wherein the exposition of the larger work is simplified, whole sections having been rewritten and chapters recast, while more illustrative facts and illustrations are furnished than are given in the large work. The treatment of the nervous system has been put at the beginning, as "a concession," and references to the corresponding fuller treatment of subjects in the larger work are given at the beginning of each chapter. And so, by slightly reduced type, we have the newest essentials of the science put within reach of everybody. We may add that Prof. Baldwin's large work has been welcomed and strongly commended abroad as well as at home. Fault may doubtless be found with details of its execution, but the spirit in which it is written, its power to awaken interest, enthusiasm, and a thirst for inquiry, are matters of greater importance, and in these respects the work is admirable.

ACTUAL AFRICA; OR, THE COMING CONTINENT. By FRANK VINCENT. With Map and over 100 Illustrations. New York: D. Appleton & Co. Pp. 541. Price $5.

MR. VINCENT'S tour of Africa began in Morocco, where customs, institutions, and public affairs are dominated by the despotic Mohammedan religion. He describes the cities, bazaars, roads, and open country, tells how the Jews and Moors live, and gives us an idea of the architecture and wonderful arabesques of the mosques. Tangier, Mequinez, Fez, Wezzan, and a number of smaller Moroccan towns were visited, and our traveler then proceeded to Algeria. While in this country, now a French colony, he made a trip to an oasis in the edge of the Sahara and saw several Roman ruins. In Tunis other Roman remains and the ruins of Carthage were visited. There is naturally more or less sameness in the cities of the Barbary states, but with the ascent of the Nile we enter upon new scenes. Mr. Vincent takes us to the sphinx and the pyramids, and in succession to the temples and tombs at Memphis, Sakhara, Beni Hassan, Assiout, Denderah, Luxor, Karnak, Edfou, Kom Ombo, Kalabshah, Aboo Simbel, and Abydos, penetrating into Nubia as far as Sarras. While describing these monuments of severe grandeur he does not neglect to give us a realistic panorama of the river banks and landing places, showing the native boats and fishermen, style of agriculture, devices for irrigation, crocodiles, donkey-boys, relic peddlers, fields of sugar cane, sugar mills, etc., etc. From Egypt he takes us through the Red Sea and southward to Mauritius and Réunion. Before returning to the mainland an extended tour is made through Madagascar, where the French are now carrying on a war with the natives. Any one who would understand the condition and resources of the country, and the character and relations of its three races of inhabitants, should study Mr. Vincent's account. He next crosses to Zanzibar, sees Tippoo Tib, and has an audi-

ence with the Sultan, who "decorates" him. Proceeding down the coast to Natal, our traveler turns inland to Johannesburg—the city of Gold—and Kimberley, going thence to the Cape Colony. In coming up the west coast the first district visited is Angola, where the habits of the natives and the arrangements for trading with them furnish much material of interest. Mr. Vincent made an extended exploration of the Congo Free State, having an opportunity to accompany the managing director of the Upper Congo Company in an expedition to explore branches of the Congo where no settlements of whites existed, and establish posts upon them. The Cameroons, the Niger Territory, the Guinea Coast, the Cape Verde, Madeira, and Canary Islands are visited in turn, and the circumnavigation of the continent is completed when Gibraltar is passed once more. The illustrations, all full-page plates from photographs, are a valuable feature of the book. They include views of cities and native villages, portraits of prominent personages, pictures of natives showing their characteristic dress (or lack of it), dancing girls, scenery, industrial operations, etc., etc. The author's descriptions are eminently satisfying, and they are so because, in addition to the main facts, he is not too dignified to put in those characteristic details which fill the gaps between the outlines and give continuity to his word-pictures.

HANDBOOK OF BIRDS OF EASTERN NORTH AMERICA. By FRANK M. CHAPMAN. Illustrated. New York: D. Appleton & Co. Pp. 421. Price, $3.

THIS is one of the most attractive and, at the same time, useful books that has come to our notice on this subject. Mr. Chapman is particularly well qualified, by long and enthusiastic study, to teach us about birds; and he has adopted an arrangement in this work which makes the subject extremely interesting, and the book a very easy one to use.

It is unfortunate that many of us are so entirely ignorant of bird life that one of the most varied and beautiful of Nature's creatures has no place in our landscape pictures; and as for their language, we are in even a worse plight. During a recent walk through the woods with a city friend, a wood thrush suddenly gave voice some little distance ahead of us. The friend immediately remarked that he didn't know crows lived in the woods. Such absolute ignorance as this is of course rather rare, but some of us are little better off. For many, a knowledge of bird lore is simply an addition to the pleasure obtained from out-of-door life; but to the large agricultural class it has an important economic value, and to the scientific philosopher the bird fills an important place in the evolutionary scheme. Mr. Chapman divides the science of ornithology into three branches—systematic, philosophic, and economic. The systematist classifies birds according to what are apparently their true relationships. "He is the ornithological storekeeper, and, having taken an account of stock, it is his duty to keep the books of the firm in order." The philosophic ornithologist, with the aid of these books, attempts to explain the reasons for and the effects of what he finds existing. "He is a seeker of causes." The economist, essentially practical, is impressed by the important part which birds play in the economics of Nature, and the value to the agriculturist of a knowledge as to whether their influence is, in a particular case, for good or evil. He says: "Few persons realize the value of birds to man. They are the natural check upon the increase of insect life; . . . indeed, it is not too much to say that without birds the earth would not long be habitable." On the last page of the introductory chapter is a heading, The Sentiment of Ornithology, under which the æsthetics of the science are considered. What impresses one most strongly in these few paragraphs is the enthusiasm of Mr. Chapman over his science. A perusal of simply this portion of the book assures one that the author's "whole heart is in his work," and that of course implies the very best results of which he is capable. In the next chapter he tells us how to study birds out of doors. How and when to find them requires a study of their haunts and migratory habits; how to identify them in the field, a consideration of the necessary outfit, such as gun, field-glasses, etc. This chapter is closed with some hints on keeping note-books and journals. Chapter III deals with collecting and preparing birds, nests, and eggs for museum specimens, and the care necessary to keep

them in good condition after their installation in the museum. A few pages are then given to an explanation of the plan of the work. One of the many valuable features of the book is a color chart containing thirty different color combinations.

The remaining three hundred and sixty pages are occupied by the descriptive matter. The distinguishing characteristics of each order are first considered, including cuts of both bill and foot when necessary. Then the families and their individuals are studied. The technical description is, in most cases, followed by some observations on the origin of the bird's common name, on a curious habit which it may have, or other interesting facts, from the pen of some careful observer in the regions where this particular specimen abounds. There are a number of very pretty full-page illustrations. The book is tastefully and strongly bound, and may readily be carried in the pocket of a fishing or hunting coat.

THINKING, FEELING, DOING. By E. W. SCRIPTURE, Ph. D. (Leipsic). Meadville, Pa.: Flood & Vincent. Pp. 304. Price, $1.50.

IN this volume the director of the psychological laboratory in Yale University sets forth the methods of what may be called the new psychology—"a psychology of fact," as he terms it, "a science of direct investigation of our thinking, feeling, and doing." He gives twenty chapters of directions for laboratory tests of reaction-time and thinking-time, steadiness, attention, power of discrimination by the senses, emotion, memory, etc., most of them requiring apparatus of more or less complex construction. The author affects no occult profundity in this work. His style is popular and the illustrations that he uses to bring home the nature of the several faculties to the student or reader are drawn from everyday life or well-known occurrences. Thus he begins the chapter on attention by declaring frankly that he can not tell what attention is. He proceeds to illustrate the process by describing the image thrown by a camera, in which the object in focus is distinctly seen while surrounding objects appear in successively greater degrees of dimness according to their distances from the focus. He then describes experiments which consist in showing pictures, letters, words, etc., to the observer for a brief time, and from which it has been learned that four or five such objects can be grasped at the same time. The following extract from his statement of the methods of forcing attention to an object will serve as a sample of his mode of treatment:

> The first law I shall state is: *Bigness regulates the force of attention.* Young children are attracted to objects by their bigness. Advertisers make it a business to study the laws of attention. American advertisers in the past and also largely in the present rely chiefly on the law of bigness. They know that one large advertisement is worth a multitude of small ones. A certain New York life-insurance company puts up the biggest building, the New York World builds the highest tower. Churches frequently vie in building not the most beautiful but the largest house of worship. . . . Bigness, however, costs. The art of successfully applying this law of bigness lies in finding the point at which any increase or any decrease in size lessens the profit.

Four other laws are stated and exemplified in similar manner, and the discussions of other topics and directions for experiments are quite as lively and simple in language as the foregoing. In the two concluding chapters the ways in which the new psychology differs from both materialism and spiritualism are pointed out and some account is given of the labors that have most contributed to its rise, with portraits of Herbart, Fechner, Helmholtz, and Wundt. There are over two hundred other illustrations showing apparatus, persons, and animals being experimented upon, diagrammatic records, etc.

THE SOURCE AND MODE OF SOLAR ENERGY. By I. W. HEYSINGER, M. A., M. D. Philadelphia: J. B. Lippincott Company. Pp. 363.

THE author takes as his guiding principle the theory that the true source of solar energy is not to be found in the sun itself, but in the potential energy of space, and that this energy is transmitted to the sun in the shape of electric currents of inconceivably high potential generated by the movements of the planetary system, which is really a huge induction machine. "All planetary space," he says, "is pervaded with attenuated vapors or gases, among which aqueous vapor occupies a leading place. The planets and all planetary bodies having opposite electrical polarity from the central and rela-

tively fixed sun, by their orbital motions around and constant subjection thereto act as enormous induction machines which generate electricity from the ocean of attenuated aqueous vapor, each planet being surrounded by an enormous electrosphere carried with the planet in its axial and orbital movements, the successive atmospheric envelopes gradually diminishing in rotational velocity until merged into the outer ocean of space. As the planets advance in their orbits they plunge into new and fresh fields, and as the whole solar system gradually moves onward through space these fields are never reoccupied. These electrospheres by their rotation generate enormous quantities of electricity at an extremely high potential —so high that we can scarcely even conceive it—and this electricity flows in a constant current to the sun, where it disappears as electricity to reappear in the form of solar light and heat." A chapter is given pointing out the difficulties in the way of accepting present theories. The book is readable and interesting, contains numerous extracts from astronomical authorities, and some well-executed cuts.

THE STORY OF "PRIMITIVE" MAN. By EDWARD CLODD. With Illustrations. New York: D. Appleton & Co. Pp. 190. Price 40 cents.

THE second of the little books in the Library of Useful Stories deals with the fascinating science of man, and with that division of it concerning which Dr. Johnson said but little more than a century ago, "We *can* know no more than what the old writers have told us." A great deal that seemed unknowable in Johnson's time, however, is now known, and Mr. Clodd here gives the general reader a comprehensive view of what we are told by the old river beds, lake bottoms, caverns, sepulchres, and refuse heaps concerning man's doings before there were any writers. Mr. Clodd is well known as the author of The Story of Creation, A Primer of Evolution, and The Childhood of Religions, and is thoroughly acquainted with the subject which he here epitomizes. After discussing the place of man in the earth's life history and the earth's time-history, he describes the implements and other remains of primitive man that have been found, and tells what may reasonably be inferred from them concerning human life at the time they were laid down. He divides this ancient period into the customary ages, but records his conviction that no hard-and-fast line can be drawn between the two stone ages. "The revolution wrought by metals," he says, "is the greatest that the world has yet seen or that it will ever see." Mr. Clodd has fully attained the ideal of the series to which he contributes this little volume. He has succeeded in telling his story in an eminently readable style, explaining all uncommon words that he was obliged to use and avoiding hosts that he might have used. He takes frequent occasion to call attention to the workings of evolution in human affairs, thus showing his emancipation from the sentiment that man is not really a part of Nature, which still hampers some men of science. There are an abundance of instructive illustrations, and for frontispiece the author has chosen the clever picture by Gabriel MAX showing the probable appearance of the "ancestors of man."

PRINCIPLES AND PRACTICE OF AGRICULTURAL ANALYSIS. By HARVEY W. WILEY. Volume I, Soils. Easton, Pa.: Chemical Publishing Co. Pp. 607.

THE chemist of the United States Department of Agriculture has undertaken the task of preparing a comprehensive manual for the estimation of soils, fertilizers, and agricultural products, and the first volume of the work is now before us. After some account of the origin of soils the author describes a variety of methods of taking samples for analysis and the preliminary treatment of the samples. Proceeding to the analysis, he takes up first the determination of physical properties, including behavior to heat, cohesion, adhesion, absorption of salts, and porosity. Another division of the work relates to the flocculation of soil particles and the separation of soil particles by a liquid, together with some miscellaneous determinations, and a chapter is given to estimations of gases. Coming to the chemical examination, methods are given for the determination of potash, lime, magnesia, manganese, iron, phosphoric and sulphuric acids, chlorine, silica, kaolin, and nitrogen. Some forty pages are devoted to determinations of

oxidized nitrogen, and a few matters of less general application are grouped at the end. Following each of the eight parts into which the volume is divided is a list of authorities cited in that part. There are ninety-three figures, mostly of apparatus. Prof. Wiley uses the new spelling of bromin, bromid, sulfur, and similar words adopted by the Chemical Section of the American Association. In gathering the material for this work he states that he has drawn freely upon the results of experience in all countries, though paying more particular attention to what has been accomplished in the United States.

INTRODUCTION TO THE PEDAGOGY OF HERBART. By CHR. UFER. Translated by J. C. ZINSER. Edited by CHARLES DE GARMO. Boston: D. C. Heath & Co. Pp. 123. Price, 90 cents.

IT is not possible to use an elementary text-book to the best advantage unless one has some conception of the point of view and ends which the author has in mind. This work attempts to give in simple, concrete manner a bird's-eye view of the ends and means of education as seen by Herbart, and serves as a guide not only to the works of Herbart himself, but also to the writings of his school. Although it has been impossible to make all the hard things easy, yet the author has certainly rendered it possible for the thoughtful teacher to make a profitable beginning.

ANIMAL RIGHTS. By H. S. SALT, with an Essay on Vivisection by ALBERT LEFFINGWELL, M. D. New York: Macmillan & Co. Pp. 176. Price, 75 cents.

IT is unfortunate that the reformer so generally overstates and misapplies his views that the people are often misled as to their real value. His zeal for his one reform obscures all other considerations, thus leading him to make impracticable and ridiculous applications of it. This has been a feature in the "prevention of cruelty to animals" movement, and the book before us is no exception. There is nothing in it especially worthy of mention; it rehearses all the old arguments, insists that we are trespassing on the animal's rights in using it for food or by catching it in a trap to protect our granaries and chicken houses, and says that we are parties in a crime when we allow our students, after the utmost precaution has been taken to avoid giving pain, to examine the workings of the vital machine in the animal. The first few paragraphs of the introductory chapter are rather deceptive, their tone leading one to expect a thoughtful and moderate discussion of the question.

GEOLOGY. By CHARLES BIRD, F. G. S. London and New York: Longmans, Green & Co. Pp. 429. Price, $2.25.

ALTHOUGH described on the title-page as "a manual for students in advanced classes and for general readers," this may properly be called an elementary book. It is written in a simple and readable style, and, so far as a necessarily brief examination shows, it omits no topic needed by one who is beginning his acquaintance with geology. Moreover, it does not go into any of the abstruse questions of the science. To facilitate the use of the book in teaching, a summary and a list of questions are given at the end of each chapter, and to enhance its worth for general readers matter has been inserted to illustrate the various points of contact which geology has with practical life, including its application to such questions as water supply, agriculture, mining, and building material. There are three hundred cuts in the text, and at the end of the volume are examination papers, a classification of the fossils, and an index.

Edward Knobel has hit upon an idea for the study of Nature that ought to prove popular. He has made *A Guide to Find the Names of all Wild-growing Trees and Shrubs of New England by their Leaves*, consisting of fifteen plates, on which are tastefully grouped leaves of two hundred and fifteen trees and shrubs, a key occupying the pages facing the plates. The whole is printed on heavy glazed paper in the form of an oblong booklet with a cardboard cover. He has undertaken a series of such guides, the second, already issued, being devoted to *Ferns and Evergreens of New England*. In this the plates are printed in white on black, which brings out the delicate tracery of the ferns very effectively. The subjects of other booklets in preparation are: Day Butterflies and Dusk-fliers, Beetles of New England,

Moths of New England, Fresh-Water Fishes, and Frogs, Turtles, and Snakes (Whidden, 50 cents each).

An introduction to the subject of *Electrical Measurements*, by *Edward Trevert* (Bubier Company, $1), is a neatly arranged little book, of convenient size for the pocket. For an amateur who is attempting practical work the book ought to be a very handy one. Its four chapters, Electrical Units, The Measurement of Resistance, Current Measurements, and Potential Measurements, occupy 117 16mo pages. There are numerous illustrations.

A condensed and convenient *Handbook of Practical Mechanics* comes to us in the shape of a 16mo from *Charles H. Saunders*, of Hartford, its author and publisher. It is intended for use in the shop and draughting room, and contains rules and formulæ for the solution of practical problems. There are numerous tables and illustrations where necessary. The last few pages contain a collection of "workshop receipts."

In *Robinson's New Intellectual Arithmetic* (American Book Company, 35 cents) we have a carefully arranged system of mental arithmetic; a science, the study of which is of great value in developing the thinking and reasoning powers, and which has a direct utility for the business man. The general divisions of the subject—addition, subtraction, etc.—are treated in the same order as in an ordinary arithmetic, and the problems are much the same, but more carefully graded.

Elementary Lessons in Algebra (American Book Company, 50 cents) is a series of lessons inculcating a knowledge of algebraic processes and giving facility in the use of algebraic symbols. They set before the learner the combinations of literal quantities into sums, differences, products, and quotients, with little reference to arithmetical processes and without associating number values to the letters—often a source of confusion to the beginner. The book is intended for use in grammar schools.

The puzzling problem of money is treated by *Arthur Kitson* in *A Scientific Solution of the Money Question* (Arena Publishing Company, cloth, $1.25; paper, 50 cents). Although acknowledging important services rendered to political economy by Jevons, the author criticises him and other economists for confusing the subject of value. He further maintains that there is no such thing as an invariable unit of value, but that there may be such a unit of purchasing power, and undertakes to show how the latter may be obtained. In his view the only proper kind of money is one that is itself valueless and the issuance of which is not made a monopoly by law. He advocates the abolition of all laws restricting the issue of currency, and says that the result would be the rise of a variety of competing systems the fittest of which would survive. During the continuance of the struggle for existence people would have to depend on their own discrimination to determine whose money it was safe to take.

The third of the Occasional Papers issued by the trustees of the John F. Slater Fund is an outline of the *Education of the Negroes since 1860*, by *J. L. M. Curry*. It tells of educational work done while the civil war was yet in progress, sketches the labors of the Freedmen's Bureau, and of various religious and benevolent associations, and gives some account of the operations under the Peabody and Slater Funds (Baltimore: The Trustees).

Mr. *C. Osborne Ward*, who is the author of several books on the labor question, has issued a volume in advocacy of communism, under the title *The Equilibration of Human Aptitudes and Powers of Adaptation* (National Watchman Company, Washington, $1.25). He maintains that the competitive system is a failure, and points out its defects, giving especial prominence to the piracy of inventions and plagiarism of literary productions. He praises the trades unions for having made important progress in the right direction, and touches upon a multitude of minor topics to illustrate or enforce his contentions. In his last chapter he gives the average longevity in a large number of occupations and comments upon the injustice that allows quicksilver miners and brakemen to die at the age of twenty-six, while the rich of no occupation, farmers, judges, and some others live till past sixty. The author gives evidence of a wide reading, and expresses himself clearly and vigorously.

Several essays on *The Nature of the State*, by Dr. *Paul Carus*, which first appeared as

editorials in The Open Court, have been collected into a half number of The Religion of Science Library (The Open Court Publishing Company, 25 cents). It is explained in the preface that the immediate occasion for the editorials was a defense of the Homestead rioters by General M. M. Trumbull, who was a contributor to The Open Court. The booklet which has now been made from them takes up first the questions, Does the state exist? and Was the individual prior to society? and goes on to discuss the nature of the modern state and the rights of its citizens to revolution.

The question of a Divine Existence is discussed by a nameless author in a small volume under the title *Matter, Force, and Spirit* (Putnams). He is neither materialist nor spiritualist, for while, as the result of his analysis, he affirms the existence of "substance—real and of final units; force dynamic, represented by motion; and force in-being, represented in its aggregate form by the attractive power of matter," he emphatically denies that "an atom and motion explain all." In the laws and phenomena of matter and force he finds conclusive evidence of a Supreme controlling Spirit, and in the phenomena of life and intelligence he sees proof "that our own being has to some degree the spiritual essence of the Divine nature." He regards God as an absolute and impersonal, but at the same time a sympathetic, near, and loving spirit.

Early in the spring a very practical (though needlessly embellished) *Spray Calendar*, compiled by *E. G. Lodeman*, was issued from the Agricultural Experiment Station at Ithaca, N. Y. It tells in tabular form when to use the spraying solutions and also gives recipes for making them. With this in the hands of every fruit-grower the bugs would have a hard time.

An account of a field investigation of *The Devonian System of Eastern Pennsylvania and New York*, made by *Charles S. Prosser*, has been issued as Bulletin No. 120 of the United States Geological Survey. The investigation was left unfinished, but it is hoped that the contribution may be of some assistance in working out the correlation of the Devonian system of this region.

The first special report of the Factory Inspectors of Illinois on *Smallpox in the Tenement-house Sweat-shops of Chicago* is instructive to all concerned with the public health of large cities. It recounts a considerable number of instances in which garments were being made on the premises where there were cases of smallpox in the epidemic of 1894 in Chicago, and tells of the artifices practiced by the Polish and Bohemian garment-makers to evade the sanitary provisions of the State factory law. It gives also a list of sweat-shops by streets, with the location of smallpox cases in the radius from which these shops draw their employees.

Bulletin No. 10 of the Minnesota Geological Survey is an account of *The Iron-bearing Rocks of the Mesabi Range*, by *J. Edward Spurr*, in which are considered the structure and character of the iron-bearing rocks, the changes they have undergone, and the length of time since their transformation. The volume is illustrated with stratigraphical sections and maps, the latter in colors, and microscopic sections of rocks.

PUBLICATIONS RECEIVED.

Allen, Grant. The Story of the Plants. New York: D. Appleton & Co. Pp. 213. 40 cents.

Bonalde, J. A. Pérez. El Kuerbo por Edgar Allan Poe. Balparaiso: Frankisko Enrrikez. Pp. 29.

Bulletins, Reports, etc. Alabama Geological Survey: Coosa Coal Field.—American Philosophical Society: Proceedings of January (1895) Meeting.—Columbia College Geological Department: A New Fossil from the Laramie Group at Florence, Col. Winglike Appendages on the Petioles of Liriophyllum Populoides Lesq., etc.; Descriptions of New Leaves from the Cretaceous (Dakota Group) of Kansas.—Illinois Factory Inspectors' Report for Year of 1894.—Iowa Health Bulletin. Vol. IX. No. 1.—Linnæan Society: Abstract of Proceedings for Year ending March 26, 1895.—National Flag Committee Proceedings: Appeal to Fifty-fourth Congress on the Misuse of the National Flag.—New England States, Vital Statistics of).—Tennessee State Board of Health Bulletin. Vol. X. No. 2.—Trinity Church Tenements, Report on Sanitary Condition of.—Wisconsin University Bulletins: A Contribution to the Mineralogy of Wisconsin (Hobbe); Studies in Spherical and Practical Astronomy (Comstock). An Experimental Study of Field Methods which will Insure to Stadia Measurements greatly Increased Accuracy (Smith).—The Finances of the United States from 1775 to 1889, with Especial Reference to the Budget (Bullock).—On the Quartz Keratophyre and Associated Rocks of the North Range of the Baraboo Bluffs (Weidman).—Utah University Quarterly. Vol. I. No. 2. Pp. 60.—Wagner Free Institute of Science: Transactions. Vol. III, Part III.—Wisconsin State Board of Health: Fifteenth Report.—Yale University Observatory: Report, 1894-'95.

Carmichael, James. How Two Documents may be found in One. Montreal; Gazette Printing Co. Pp. 22.

Carus, Paul. The Gospel of Buddha. Chicago: Open Court Publishing Company. Pp. 275. 25 cents.

Gage, A. P. Principles of Physics. Boston: Ginn & Co. Pp. 634. $1.55.

Grindon, L. H. The Sexuality of Nature. Boston, Mass.: New Church Union. Pp. 124. 75 cents.

Guerber, H. A. Contes et Legends. Pp. 181. 60 cents; and Myths of Northern Lands. Pp. 319. $1.50. New York: American Book Co.

Hensoldt, Heinrich. Prospectus of Popular Lectures on Oriental Travel. Pp. 14.

Hertwig, Oscar. The Cell. Translated by Henry Johnstone Campbell. New York: Macmillan & Co. Pp. 368. $3.

MacClure, Theodore R. Rabies. Pp. 50.

Macnie, John. Elements of Geometry. New York: American Book Co. Pp. 374. $1.25.

Miall, Prof. L. C. The Natural History of Aquatic Insects. New York: Macmillan & Co. Pp. 389. $1.75.

Parkes, Louis. Elements of Health. Philadelphia: P. Blakiston, Son & Co. Pp. 245. $1.25.

Practical Science Monthly. Devoted to the Practical Application of Scientific Electrical Research. Vol. I, No. 1. Pp. 30.

Singleton, M. T. Gravitation and Cosmological Law. Atlanta, Ga.: Franklin Publishing Company. Pp. 21.

Smith, John B. (Smithsonian Bulletin). Contribution toward a Monograph of the Lepidopterous Family Noctuidæ of Boreal North America. Pp. 126.

Warren, L. E. Speech revealed in Facial Expressions. New York: Edgar S. Werner. Pp. 15.

Webster's Academic Dictionary. New York: American Book Co. Pp. 704. $1.50.

Winter, Noel. Pan-Gnosticism. New York: Transatlantic Publishing Company. Pp. 184.

POPULAR MISCELLANY.

The Red Cross.—The organization known as the Red Cross is the result of the international treaty of Geneva, and has for its object the prevention or amelioration of suffering incurred in war. All military hospitals under its flag are neutral, and can not be attacked or captured. Surgeons, nurses, chaplains, attendants, and all non-combatants wearing its badge, all supplies, and whatever else, under its care, are likewise protected. In this country it has a civil branch, known as the "American Amendment," which other countries are adopting, and which provides relief against woes arising from fire, flood, pestilence, and other national calamities. As late as the Crimean War, civil help for military necessities was unknown, and Florence Nightingale walked into a pathless field. In our own civil war relief was afforded by the Sanitary and Christian Commissions. The Red Cross became active first in the Franco-German War of 1870–'71, and the annals of that war were not stained by any record of needless inhumanity or cruelty to wounded or sick. Since then no war between nations within the treaty has taken place in which the Red Cross has not done its work, maintained its position, and been respected. Under the "American Amendment" it has had a share, according to Miss Clara Barton, its originator and leading spirit, in relief work in the case of the forest fires of Michigan in 1881; the overflow of the Mississippi in 1882; the drought in Texas in 1886; the relief of the sufferers from the Mount Vernon cyclone in 1888; the yellow-fever epidemic in Florida in 1888; the Johnstown disaster in 1889; the Russian famine in 1891–'92; and the hurricane and tidal wave of the South Carolina sea-island coast in 1893–'94. It has also, during that time, taken part in several international movements.

Unsolved Problems in the Manufacture of Light.—In a lecture before the Royal Society of Canada, on Unsolved Problems in the Manufacture of Light, Prof. John Cox showed that in practice not more than from seven to sixteen per cent of the energy stored in the coal can be extracted by the steam engine, and theoretical considerations fix an absolute limit to the perfection of that machine, so that we can never hope to convert so much as thirty per cent of the coal by any form of heat engine. This is one of the unsolved problems—unsolved, but still capable of solution if some means of extracting energy from coal otherwise than by heat, and more like the methods used in burning zinc in a battery, can be discovered. In the second stage of the process for producing the electric light, the dynamo is already nearly perfect, and hardly any heat is lost in its conversion into an electrical current. We reach the third stage, the lamp, with some seven per cent of the original energy still available. In this stage our only means of producing luminous energy is to heat the molecules of some substance, whereby we are compelled to waste the greater part of our efforts in producing heat, which is worse than useless, before we obtain the light rays. "Here, then, is the second unsolved problem, since even in the incandescent lamp and the arc lamp not more than from three to five per cent of the energy supplied is converted into light. Thus of the original store in the

coal less than three parts in a thousand ultimately become useful. In the last six years, however, some hint of means to overcome the difficulty has been obtained from the proof by Maxwell and Hertz that light is only an electric radiation. Could we produce electric oscillations of a sufficient rapidity, we might discard the molecules of matter and directly manufacture light without their intervention. To do this we must be able to produce oscillations at the rate of four hundred billions per second. Tesla has produced them in thousands and millions per second, and Crookes has shown how by means of high vacua to raise many bodies to brilliant fluorescence at a small expense of energy. . . . These are hints toward a solution of the problem, but give no solution as yet. Prof. Langley states that the Cuban firefly spends the whole of its energy upon the visual rays without wasting any upon heat, and is some four hundred times more efficient as a light producer than the electric arc, and even ten times more efficient than the sun in this respect. Thus, while at present we have no solution of these important problems, we have reason to hope that in the not distant future one may be obtained, and the human inventor may not be put to shame by his humble insect rival."

Friends of the Farmer.—The common white grub, the larva of the June bug, well known as a destroyer of potatoes and the roots of corn, is eaten by a considerable number of small animals. Among those mentioned in the eighteenth report of the State Entomologist of Illinois are thrushes, blackbirds, bluebirds, owls, hawks, the catbird, robin, and some other birds, also pigs, moles, ground squirrels, skunks, toads, and frogs. It is probable that snakes also eat them. Several of the above-named creatures are too destructive themselves to be encouraged on farms, but others either do no damage at all or a trifling amount compared with the service they render. Poultry might have been added to the list given in the report.

Significance of Human Variation.—The Shattuck Lecture, delivered by Prof. Thomas Dwight at a recent meeting of the Massachusetts Medical Society, was on the Range and Significance of Variation in the Human Skeleton. In it the author, who is convinced that every bodily difference between man and non-rational animals is of degree and not of kind, expresses himself "astonished and perplexed by the great network of analogies extending throughout Nature. No one can ignore them without willfully shutting his eyes. But the very multiplicity of these resemblances assures me that some other law than that of heredity must be invoked to account for them. They can not be represented by a treelike figure. They spread out every way. The opinion is daily growing stronger among serious scholars that, if man's body came from a lower form, it was not by a long process of minute modifications, but by some sudden, or comparatively sudden, transition. The fabulous missing link, once so accurately described by Haeckel, is retreating to the limbo of worn-out hypotheses."

Coloration of Birds' Eggs.—The explanations put forth to account for the variations in color of the shells of birds' eggs are arranged by Dr. R. W. Shufeldt in his paper on that subject as follows: In many instances the general color and markings were in conformity with the law of protective coloration. When both sexes are more or less brilliantly colored, the eggs are generally laid where they are not exposed to view, and where the parent hatching them is also concealed to a greater or less extent. This is effected by either the form of nest constructed or by the eggs being laid in burrows or hollow trees. The eggs of such birds are, as a rule, not handsomely marked, or are often only white. When the general tone of the plumage of the incubating parent is in harmony with its environment, the eggs, as a rule, are laid in open nests or places where they are fully exposed to view; such eggs are often very handsomely tinted and marked, or the reverse may be the case. Frequently birds that lay eggs in open and exposed places, as directly on the ground, rock, or sand, without any apology for a nest, have eggs that are either tinted, or colored and marked, or both, so as to be in harmony with their surroundings. The earliest forms of birds probably laid white, ellipsoidal eggs, varying in number to the clutch from one to many. Possibly in some of the lower types of exist-

ing birds such an ancestral trait has persisted. In certain instances where birds lay exposed to view either white or light-tinted eggs, or those not otherwise protectively colored, they have the habit of covering the clutch over with leaves, etc., when the incubating parent temporarily quits the nest. The eggs of birds, irrespective of the character of the coloration of their plumage, which habitually lay in inaccessible places, are often either white or light-tinted and exposed to view. Both the age of the bird and the physical condition of its constitution at the time of laying an egg have their influence upon the coloration of its shell. Changes in the constitution may be due to external causes, as fright, etc.; or to internal causes, as disease, etc. The richest-colored eggs of any species (that lay other eggs than white ones) are laid by that species at its prime. The positions of the egg as it passes down the oviduct, as well as its motions, affect the pattern of its markings.

The Great Siberian Railway.—Of the total length of nearly four thousand seven hundred miles of the great Siberian Railway, the rails are already laid over one thousand and six miles, or sixty-eight miles more than one fifth of the whole distance. In this are counted the distances built from the eastern end at Samara to the Irtysh opposite Omsk, and at the western end from Vladivostok along the Usuri River. There was some doubt at first whether the road should follow the northern route, where a railroad is already built along the old caravan road, through Ekaterinburg to Tyreman, on the Tura, or on the southern line where the advantages of population and traffic in central Siberia are more tempting. The southern route was chosen, and the railway, starting from Samara, passes through the densely peopled parts of south Siberia to Ufa, at the junction of the Byela and Ufa Rivers, thence to Zlatonst, the center of the great iron and gold mining district of the southern Urals, when it crosses the mountains, and to Chlyabisk, on the borders of the prairies of southwest Siberia; thence to Omsk, the present terminus, Tomsk, Krasnoyarsk, Irkutsk, Chita, and the southern coast of Lake Baikal. Here a way will have to be cut through the rocky crags that rise abruptly from the waters of the lake; and between Chita and the Amur a series of parallel ranges will have to be crossed. Owing to the unfavorable character of the region for population, the railway between the Amur and the Usuri will probably remain for some time to come a mere strategic line.

Climate of the City of Mexico.—A report by the Director of the Meteorological Observatory of Mexico, published by the director, Señor M. Bárcena, on the climate of that city, gives the mean annual temperature as 59·7°, and the monthly means as ranging from 53·6° in December to 64·6° in May. The absolute maxima in the shade vary from 73·4° in December to 88·9° in April, and the absolute minima from 28·9° in December to 46·8° in August and September. The greatest daily range amounted to 41° in the month of March. The mean annual rainfall amounted to 23·8 inches, the wettest months being June and September. The greatest fall in one day was 2·5 inches in August, 1888. The prevalent wind is northwest, which blows during most of the year, and that is the coldest and wettest quarter. The strongest wind blows from the northeast. The greatest hourly velocity observed was about fifty-six miles an hour. The report is based upon the hourly observations of the sixteen years, 1877 to 1892.

Luchu Island Snake.—Peculiar to the Luchu Islands is the poisonous Trimeresurus snake, called *habu* by the natives, which is described by Prof. B. H. Chamberlain, of the Imperial University of Japan, as being four or five feet long by two inches in diameter, and as an object of universal fear and hatred. It springs out at passers-by from the hedges, where its habits lead it to lie in wait for birds, and actually enters houses, so as to make it perilous during the warm season to walk about the house at night except with a lantern. The general result of bites that do not bring on death is lifelong crippling. Rewards are offered by the authorities for the bodies of these snakes, dead or alive, and the villagers go out in the woods to secure them. Yet the number does not seem to diminish perceptibly, and at least one case is recorded within recent years of a village having been abandoned by its inhabitants be-

cause they could not cope with these enemies. Sea snakes are common on some of the islands, of three species, two of which are harmless, while the bite of the other is poisonous. These sea snakes are highly prized, as vipers are in Japan, and are used as food by the rich and, to a smaller extent, as medicine by the poor.

Smoke.—The following, from the American Engineer and Railroad Journal, seems worthy of mention: A mistaken idea exists as to the amount of actual carbon contained in those dense masses of smoke which are seen rising from the tall stacks of manufacturing and other large plants. By passing through water the gases arising from a furnace burning bituminous coal, and weighing the solid particles retained or precipitated, it has been proved, it is claimed, that they amount to less than one sixth of one per cent of the total amount of coal consumed. It is not strange that a different idea is entertained of the quantity of actual carbon seemingly going to waste, when the wonderful coloring power of the finely divided particles of carbon is considered. To prove this it is only necessary to try the well-known experiment of smoking a bit of glass with a candle, and then mixing up with a palette knife a portion of the coloring matter thus secured with a drop or two of gum arabic. A very small portion of this mixture will color many quarts of water. The actual carbon contained in the smoke itself is inappreciable, but the unconsumed invisible gases invariably associated with the smoke are considerable in quantity and indicative of a financial loss much larger than is generally known.

Therapeutic Hypnotism.—The unmistakable signs of the failing belief and interest in hypnotism as a curative agent, and its relegation to the field of curious if not pathological psychology, is pointed out in the editorial columns of the last Lancet. The two deciding questions, about which controversy has raged, have been, first, Are hypnotic phenomena physiological or pathological? and, secondly, Has the induction of hypnosis any therapeutic value? A study of the most successful hypnotic subjects seems to indicate that the phenomenon is really a morbid one, and "associated with feebleness of will and unusual impressionability," and as regards its therapeutics, while it may be of some value in certain functional nervous diseases, such as hysteria and neurasthenia, there are other methods of producing the same effect which have none of the dangers, both moral and physical, with which hypnosis is fraught.

Diphtheria and Milk.—A curious epidemic of diphtheria following a sore throat, caused by drinking a certain milk, is recorded in the British Medical Journal. On the outbreak of the sore throat the milk and its surroundings were closely examined: some of the cows had sore teats; but no disease in the throats of either cows or milkers could be discovered, and there were no Loeffler bacilli in the throat scrapings from the patients. Upon boiling the milk before using, the epidemic promptly subsided. But within less than a week a true epidemic of diphtheria appeared among these same people, and, although careful investigation was made, no source of secondary infection could be discovered. It seems probable that the throat trouble caused by the milk laid the foundation for the diphtheritic bacillus. The outbreak was a very mild one, only one death occurring.

Physical Measurements of School Children.—In J. Allen Gilbert's researches on the mental and physical development of school children, the results in the observations of muscle sense, or sensitiveness to weight, showed a gradual increase in ability to discriminate, from six to thirteen years of age. At thirteen there was a gradual falling off and then another gain. Boys and girls, considered together, gradually increase in ability, but when they are considered separately, marked differences of sex appear. At six years the considerable difference is in favor of the boys; at seven both sexes have the same ability. From this on both gain with equal pace to the age of thirteen, with the exception of an abrupt falling off for boys at eleven. From thirteen to seventeen the difference again becomes manifest in favor of boys. Ability to distinguish different shades of the same color increases with age. The balance of advantage in this test is slightly

in favor of the girls. Voluntary motor ability is measured by the number of taps the child can make in five seconds. The average child at six years taps 20·8 times in that interval. From this there is a gradual increase till the age of twelve, when the rate is 29·9 taps. This is lowered one tap at thirteen, after which the increase is resumed and reaches a maximum at seventeen, when the rate of tapping is 33·8 in five seconds. The rate is higher for boys than for girls. After tapping for forty-five seconds fatigue enters into the results very noticeably. The fatigue is most marked at the age of eight and least marked at fifteen. Boys tire more quickly throughout in voluntary movement than girls, but as they act more vigorously it can hardly be said that they tire more easily. Boys have a larger lung capacity than girls throughout. Girls become nearly stationary in it at twelve, but boys do not begin their most rapid growth till they are fourteen years of age. The time of simple reaction decreases with age. The results, when considered for girls and boys separately, show marked differences in sex. The bright children react more quickly than the dull. But all react in about the same time just before those ages—eleven and sixteen—in which changes of growth manifest themselves. In the test for reaction with discrimination and choice, ability increased and the length of time required decreased with advance in age. This test implies more complicated mental activity, and the influences that affect mental life show themselves more plainly in the curve representing such development.

Uses of the Sand Blast.—It appears from an account of the applications of the sand blast given by Mr. J. J. Holtzapffel, in the English Society of Arts, that glass is almost immediately depolished by the blasts now in use, and only a little time is required to pierce and cut holes through sheet and plate glass. Stone, marble, slate, and granite are equally amenable to its action. Iron, steel, and other metals have their surfaces easily reduced and smoothly or coarsely granulated, according to the force and abrasive powder used. The abrasive need not be harder than the metal to which it is applied. The blast is used for frosting and decorating glass, the labeling of graduated measures, for removing hard scale from castings and forgings, for carvings and inscriptions in intaglio or relief on stone, slate, and granite, for delicate drawings for lithography, for removing fur and deposits in tubs and tanks, for cleaning off accumulations of paint and dirt within iron ships, for decorating buttons, for piercing the holes in glass ventilators, for marking pottery and ornamental tiles, for refacing grindstones, emery and corundum wheels, for granulating celluloid films for photography, and on wood to bring out the grain in relief, and, latterly, for blocks for printing.

Tuberculosis in Meat.—The Royal Commission appointed in July, 1890, to inquire into the effect of food derived from tuberculous animals on human health has reported, as the result of its five years' investigations, that it has obtained ample evidence that "food derived from tuberculous animals can produce tuberculosis in healthy animals. The proportion of animals contracting tuberculosis after experimental use of such food is different in one and another class of animals; both carnivora and herbivora are susceptible, and the proportion is high in pigs. In the absence of direct experiments on human subjects we infer that man also can acquire tuberculosis by feeding upon materials derived from tuberculous food animals. The actual amount of tuberculous disease among certain classes of food animals is so large as to afford to man frequent occasions for contracting tuberculous disease through his food." The commission thinks it probable that an appreciable part of the tuberculosis that affects man is obtained through the food. Tuberculous disease is observed most frequently in cattle and in swine. It is found far more frequently in full-grown cattle than in calves, and with much greater frequency in cows kept in town cowhouses than in cattle bred for the express purpose of slaughter. It is but seldom found in the meat substance, but principally in the organs, membranes, and glands. It is found in the milk of cows when the udder has been attacked by tuberculous disease, and seldom or never when the udder is not diseased. In the milk it is exceptionally active in its operation upon animals fed either with the milk or with dairy produce derived from it. Provided every part that is the seat of tubercu-

lous matter be avoided and destroyed, and provided care is taken to save the actual meat substance from contamination by such matter, a great deal of meat from animals affected by tuberculosis may be eaten without risk to the consumer. Ordinary processes of cooking applied to meat which has got contaminated on its surface are probably sufficient to destroy the harmful quality. They would not avail to render wholesome any piece of meat that contained tuberculous matter in its deeper parts. The boiling of milk, even for a moment, would probably be sufficient to make it safe.

Similarities in Culture.—Prof. O. T. Mason closes a somewhat critical discussion of similarities in culture—on which, he suggests, more is sometimes built than can stand—with the conclusion that such similarities may arise through a common humanity, a common stress, common environment, and common attributes of Nature; through acculturation, or contact, commerce, borrowing, appropriating, between peoples in all degrees of kinship; and through common kinship, race, or nationality. Generic similitudes arise by the first cause; special and adventitious similarities by the second cause; and the more profound, co-ordinated, real, and numerous similarities by the third cause. Similarities are partly natural, such as sounds of animals, forms of pebbles, qualities of stone, clay, and the like, but most of them are fundamentally ideal. Where the same idea exists in two areas, a simple one may have come to men independently. One containing two or more elements in the same relation and order is less likely to have so arisen, while a highly organized idea could not often have come to two men far removed from one another. Furthermore, a complex idea is never the progeny of a single mind, and that embarrasses the question further. The generic and adventitious similarities are most striking and most frequently called to notice. The error is in taking them for profound and real similarities. Those similarities that are imbedded in the life of peoples and logically co-ordinated with the annual circle of activities are of the family and stock, and beyond any reasonable doubt proclaim the people to be one. "Furthermore, they exist for the trained and patient eye and hand; they elude the gaze of the superficial observer. The identification of them is the reward of long years of patient research, and the finder is the discoverer of a pearl of great price."

Electric Cooking Vessels.—The first attempt in practice to devise vessels for cooking by electricity was made about four years ago by a Mr. Carpenter, an American, who developed Lane Fox's idea of surrounding the vessel by a coil of insulated wire through which a current should be passed. He attached the resistant wires to the surface of cast-iron plates by an enameling process. Some defects appeared in his method, among which was the liability of the enamel to crack, whereby the wire was exposed to the oxidizing action of the air. These difficulties have been overcome by the English manufacturers Crompton & Co., who have found a safer enamel and substituted a nickel-steel wire as being better adapted to endure the action to which it is exposed than the wire that was used before. By specially adapted methods they are able to apply the wire in somewhat complicated patterns to the surface of any metal plate, and to insulate it therefrom in a very thorough and permanent manner. They exhibit, constructed on this plan, a simple electric heater—a circular plate mounted on short legs, to the under side of which wire is applied and fixed by the enamel, while the upper side is ground flat and polished—a frying pan, saucepan, kettle, griller, hot iron, and radiator. The radiators have been found convenient, safe, and economical for heating theaters and efficient in preventing the deposition of frost on shop windows.

Formation of Stalactites.—Describing the deposition of carbonate of lime in stalactites and stalagmites, Mr. George P. Merrill, of the United States National Museum, says that water filtering through a rock roof, by virtue of the carbonic acid it contains, is enabled to dissolve a small amount of the lime carbonate, which is again deposited when the excess of carbonic acid escapes either through relief from pressure or through the evaporation of the water. Conditions favorable to either process are furnished by the water filtering through the

roof of a cave and dripping slowly to the floor beneath. In cases where the water filters sufficiently slowly or evaporation is correspondingly rapid, the deposit of lime carbonate from the roof takes at first the form of a ring around the outer portion of the drop, a natural consequence of the evaporation of a suspended drop of liquid. This process may go on until the ring becomes prolonged into an elongated cylinder or tube, the diameter of which may not exceed five millimetres, though usually ranging from five to ten, and of all lengths up to fifty centimetres. In exceptional cases this length may be exceeded, but owing to the delicacy of the material the stalactite usually breaks from its own weight and falls to the floor before the length of even ten or fifteen centimetres is reached, to become imbedded in the stalagmitic material there forming. Lengths of even these dimensions are comparatively rare, for the reason that the tube becomes shortly closed, either as its upper or lower end, usually the upper, and all growth from the extremity alone ceases, subsequent depositions being wholly exterior and taking place in the form of concentric coatings of the carbonate on the outer surface and at the same time from the top. There is thus formed around the original tube a compact cylindrical mass, in its typical form, constricted at the point of attachment, but thickening rapidly and then tapering gradually into an elongated cone. The material of the stalactites is not always wholly carbonate of lime, but in some cases thin intervening coats of iron disulphide are met with. Through a kind of crystallization the material sometimes undergoes a distinctly fibrous arrangement, but oftentimes the structure is granular throughout.

Snake-bite Antitoxine.—At a recent meeting of the Royal Society of Edinburgh Prof. Fraser delivered a lecture embodying some extremely valuable and interesting data obtained by him during several years of experimental work on an antidote for snake poisons. The principles utilized by him are similar to those employed in the antitoxine treatment of diphtheria and in vaccination for smallpox. He first immunized an animal by repeated small doses of the snake poison, slowly increasing the quantity, until the animal was taking at a single dose many times the minimum lethal amount for a non-immunized individual. He then injected into another animal some of the blood serum from the immunized case, and found that this prevented any ill effects from a subsequent injection of venom. Still a third animal was given an injection of pure venom, and, when distinct symptoms of poisoning appeared, was treated with the immunizing serum, with the result that the symptoms of poisoning disappeared and no ill effects followed. When it is remembered that in British India alone there are each year from eighteen to twenty thousand deaths caused by snake-bite, the great beneficence of this discovery is apparent. Prof. Fraser is at present immunizing a horse, but is having some trouble, owing to the difficulty of procuring the snake-poison in sufficient quantity.

Unsanitary Filters.—For many years before any positive connection was established between typhoid fever and a specific micro-organism it was known that this and other diseases were in some way connected with the composition of the drinking water previously consumed by the patient. By chemical analysis it was found that in almost all such cases the water contained an excess of organic matter; it was accordingly inferred that removing the organic matter would correct the trouble and obviate any further danger; and filters were made with this end in view. It is now known, however, that the danger from waters containing much organic matter lies not in the organic matter *per se*, but arises from the fact that a large amount of organic matter attracts and feeds a proportionately large number of bacteria. It has been proved experimentally that after a filter of this class has been in use for some time, water, in passing through it, becomes much richer in bacteria, and even that sterilized water passed through it is found swarming with micro-organisms. The filter collects the organic matter from the water and with it some of the bacteria. This mass of organic matter serves as an admirable culture medium; as the bacteria multiply, they are taken up by the water as it passes through the filter, so that, instead of serving as a safeguard against disease, such filters are really disease breeders. In order to be

effective, a filtering apparatus must either remove or destroy any micro-organisms contained in the water.

Color Photography.—At a recent *soirée* of the Royal Society, in London, Dr. Joly, of Dublin, exhibited some photographic transparencies upon glass plates representing various objects in their natural colors. The subjects photographed were especially chosen because of variety of color and delicate shading, and were reproduced with great naturalness and fidelity. The results were accomplished by the use of a finely ruled glass plate, two hundred to three hundred lines to the inch, each three lines being a complete color series, consisting of an orange-yellow line, a greenish-yellow line, and a blue-violet line, these colors being repeated over and over again. The lines are ruled with colored inks, made up of gum and gelatin mixed in certain proportions, on a gelatin-coated plate. The plate to be exposed is placed in contact with this color-screen, and only exposed to light which has passed through the latter; an extra-long exposure is necessary, owing to the partial opacity of the color-screen. The plate is then developed in the ordinary way. The color-screen is now again placed against the negative, and when the two are held up to the light, if the color-screen is placed just as it was when the exposure took place, an accurately colored reproduction of the original scene appears. The process is so simple and inexpensive that it will probably come rapidly into general use.

The Value of Object Lessons.—In a recent educational circular we find the following on object teaching: "To sum up the main value of object teaching, there are three principal uses: The first and most important is to teach the children to observe, compare, and contrast; the second is to impart information; and the third is to re-enforce the other two by making the results of them the basis for instruction in language, drawing, number, modeling, and other handiwork. There are, however, other important uses of good object teaching. It makes the lives of the children more happy and interesting by opening up an easily accessible and attractive field for the exercise of brain, hand, and eye; it gives the children an opportunity of learning the simplest natural facts; and directs their attention to external objects, making their education less bookish. It further develops a love of Nature and an interest in living things, and corrects the tendency, which exists in many children, to destructiveness and thoughtless unkindness to animals, and shows the ignorance and cruelty of such conduct. The value of the services which many animals render to man should be dwelt upon, and the importance of kindly treating them and preserving them should be pointed out. By these means, and in other ways, good object teaching may lay the foundation for the right direction of the activity and intelligence of the children throughout the whole school."

Sunlight and Pictures.—The question of preventing or mitigating the fading of pictures and pigments has been attacked in earnest and in a practical way by Captain W. de W. Abney, who finds that fading in the course of time is one of the inevitable effects of the operation of ordinary sunlight. Pictures can not well be taken from the light, so the next best thing is to discover which of the solar rays do the most damage, and to mitigate their effects as far as possible. The violet rays prove to be most active in producing fading. If we can eliminate the majority of these rays from white light without appreciably altering the freshness of the colors viewed in such light, we shall practically have prolonged the life of a picture. A variety of experiments made with different pigments tell us that the loss of the violet of the spectrum is practically no loss at all. Even with white light the loss is unnoticeable. If we form a patch of light composed of all the colors except the violet, we shall notice but little change from the pure white that is alongside of it. The case becomes simpler yet when we find that the blue-green light and the yellow light of the spectrum superposed give substantially white. A blue-green glass and a yellow glass interposed against the sunlight practically cut off all the violet, while they give passage to the rays that form white. Captain Abney therefore solves his problem by using glasses of these colors for the window-glazing of his gallery. Making the windows

and skylights with alternate strips of these colors, he has a light which when diffused blends into a practical white that allows the pictures to be seen as under usual conditions, while the danger of fading is made the smallest possible.

Pimento.—Pimento, allspice, or Jamaica pepper is the dried berry of the pimento tree of Jamaica, which grows to the height of twenty or thirty feet; and the markets of the world are wholly supplied from this source. The tree will not grow on the coast lands, but flourishes best on the mountains of the interior of the island. The tree from the leaves of which the aromatic principle of bay rum is extracted (*Pimento acris*) is also a native of Jamaica, but its cultivation has been neglected. The pimento tree is a plant of paradoxes. It is not friendly to cultivation, so that it has not been found possible to rear healthy plants from the seeds by artificial planting; and the stock can not be successfully increased by slips. The seedlings thrive, however, when the seed has been digested by a bird, and this source of supply is largely relied upon. When it is desired to stock land with pimento, the trees growing upon it are cut down and their trunks are left lying where they fell. The bushes and the brush are burned, and the ground is planted with provision crops. After the lapse of some months, young pimento plants may be seen springing from the soil in various places. Care must be taken to keep cattle from them, for they are very fond of the spicy leaves and would destroy the young plants. After two or three seasons cultivation is stopped and the grass is allowed to grow. Cattle are permitted to pasture on the land after the trees have grown out of their reach. The planter has now only to keep the land clear of brush and to gather his crops. The harvest begins in August, just before the berries turn black. One of each party of pickers climbs the trees, breaks off the berry-bearing branches, and throws them down to his comrades, who strip off the berries. The tree is left in a ragged condition, and the process seems to be a barbarous one, but it is said to be best for the trees. If they are pruned, the branches cut die to the main stem; while if the limbs are broken off they shortly send forth new shoots; and it is claimed that the year's yield depends largely on the extent to which the limbs have been broken the previous season. The crop is next cured by drying, winnowed, and prepared for the market. Pimento holds the fifth place of importance in the exports from Jamaica, being exceeded in value only by sugar, rum, coffee, and fruit; but the demand for it is declining, and its importance is therefore growing less.

The Tricks of Worthless Companies.—A report lately published by the English Board of Trade on the working of the Companies Winding-up Act during 1893 reveals some startling facts indicating mismanagement. Winding-up proceedings were begun during the year against more than a thousand companies out of a total of 16,104 in England and Wales, while 2,332 new companies were started. The whole number of liquidations during the two years 1892–'93 was nearly equal to one half of the number of companies formed during the same period. Besides these, a large number of new companies annually prove abortive and cease to exist, or, if their names are not taken from the register, remain there as moribund companies. From the figures of the past year it would appear that nearly two thirds of the companies formed fail to establish themselves as permanent enterprises. The report exposes the manner by which fraudulent or mistaken estimates have enticed simple and believing investors to risk and lose their savings. Malpractices begin with the prospectus and continue till liquidation. One case is cited in which the property sold to the company for two hundred and fifty thousand dollars had been bought a few months before by the promoter for three thousand dollars. In another case the interest in the publication of a periodical was bought by the promoter in June for fifteen hundred dollars in cash, and was sold in August to a company, practically consisting of himself, for fifteen thousand dollars in cash and fifteen thousand dollars in debentures, with a view of ultimately disposing of it to the public at a price based upon these figures. In another instance a small and worthless business was represented as a business in the various centers of industry in England

and Ireland, firmly established and very lucrative, and a safe investment, which would, according to the report of an expert sent out with the prospectus, return, taking the previous year's business as a criterion, a profit of fifteen per cent. The worst of the matter is that the report confesses that the statements, false as they were, were not of such specific character that they could be made the subject of criminal indictment.

NOTES.

A PRACTICAL piece of work is reported in the bulletin of the University of Wyoming. This is a series of determinations of the heating power of fifty-four samples of Wyoming coal, six of petroleum, and two of asphalt, by Prof. Edwin E. Slosson and Prof. L. C. Colburn. Proximate analyses of the coals and a description of the bomb calorimeter used for the heat tests are also given.

IT appeared in observations made in Russia during two years that at the depth of about a foot and a half the soil in the open steppe holds only about two thirds as much moisture as the soil of the woods and their immediate borders. The snow covering on the steppe on the 20th of February corresponded with only one third as much water as that in the forest. Frost reached four times the depth in the open land that it did in the woods. In summer, the upper layers of the ground were most dried in the open land, the deeper layers in the forest. It was therefore inferred that the action of trees is one of drainage. Woods planted in the steppes protect the ground against the direct effects of the sun and the wind, but utilize most of the water that falls. The existence and growth of groves depend on water coming from without. The subsoil moisture is too deep down to be available for the young plantations.

Two customs, supposed to be of Thibetan origin, were noticed by the American traveler W. W. Rockhill, as observed by Mongols in connection with the fireplace. When the party had finished drinking a big kettle of tea, the men put the leaves on the hearthstones on which the kettle rested. This practice was held to be equivalent to burning incense or making an oblation to the gods, and is usually observed by the Chinese frontiersmen, even though they profess Islamism. In case a hearthstone cracks, they are always careful to smear it with a little butter—"for good luck," they say.

OF the results of recent antarctic exploration, Prof. Angelo Heilprin, in an address on the Progress of Discovery, mentions the penetration by two Norwegian vessels on the opposite sides of Graham Land to the sixty-eighth and sixty-ninth parallels of latitude, thus far the "farthest south" positions. They discovered new lands and islands, which they called King Oscar II Land, Weather, Robertson, Christensen, and Lindenberg Islands; and found that the supposed continental mass of Graham Land is possibly an archipelago. Two of the islands have active volcanoes. In the arctic regions Captain Johannessen has discovered a new land which he calls Hansenland, fifteen miles northwest of the New Siberian Islands. The new land is described as ruggedly barren, nearly destitute of vegetation, having high mountains, and supporting gigantic glaciers.

PROF. J. KOLLMANN communicated to the British Association in 1894 the discovery at Schaffhausen, Switzerland, in neolithic interments, side by side with the remains of full-grown European types, those of small-sized people, presumably pygmies of that age. The situation of the remains indicated that the two races lived peacefully together. In connection with this find it is observed that Sergi and Mantie have discovered some living pygmies in Sicily and Sardinia, looking like miniature Europeans. The Schaffhausen bones are declared by Virchow not to be of a pathologically degenerated people, but of those of normal structure. In the author's opinion these small types must not be regarded as diminutive examples of normal races, but as a distinct species of mankind, which may have been the precursor of the larger types of man.

AN interesting and instructive enterprise, an International Exhibition of Hygiene, organized under the direction of M. Brouardel, was recently opened in Paris. The exhibits were grouped as follows: (1) Hygiene of Private Houses. (2) City Hygiene. (3) The Prophylactics of Zymotic Diseases, Demography, Sanitary Statistics, etc. (4) Hygiene of Childhood, including Alimentary Hygiene, Questions of Clothing, and Physical Exercises. (5) Industrial and Professional Hygiene.

THE International Geographical Congress, which met in London from July 26th to August 3d, had a very successful and interesting week. The exhibits included a series of maps showing the development of English cartography; portraits of explorers and geographers from the thirteenth or fourteenth century down to the present day; a series of globes constructed by von Ravenstein to show how knowledge of the earth's surface has grown from century to century; many rare and curious old maps; a very large collection of photographs representing types of scenery in all parts of the world; and an extensive collection of geographical instruments, both ancient and modern. The

congress was divided for convenience into two sections, one dealing with educational and the other with mathematical geography. Most of the prominent geographers of the world were present, and much valuable work was done. The visitors were entertained in royal style, and the social features were not the least attractive part of the meeting.

THE yellow coloration of milk on exposure to heat is due, according to M. Cazeneuve and M. Haddon, to the oxidation of the lactose in presence of the alkaline salts of the milk. Lactose during this oxidation yields acids, especially formic acid, easily detected, the presence of which suffices to explain the coagulation of the milk as it ensues with any acid.

THE French Association for the Advancement of Science will meet at Bordeaux, from August 4th to August 9th, under the presidency of M. E. Trelat.

THREE cases of tuberculosis following tattooing are reported in the British Medical Journal. Three boys were tattooed by the same woman, who used her saliva as a vehicle for the coloring matter. The woman died soon afterward with pulmonary tuberculosis, and all the boys presented unmistakable signs of tuberculosis at the site of the operation.

BACTERIOLOGY has taken up the telephone as a disseminator of disease, and may make necessary the adoption of some device by which the danger of infection from the mouthpiece, which many people allow to touch the lips, can be avoided. The medical journals of Paris are agitating the matter.

THE ultra-conservatism which is so certainly bred by life about an old university was sadly illustrated recently at Oxford by the rejection of a proposal to include anthropology among the subjects of the final school of natural science not as an extra but as an equivalent subject. There are unfortunately still in high positions classical teachers who believe that science is an unessential part of a nineteenth-century education.

RATHER a novel contrivance for utilizing air currents in irrigation is described in the Louisiana Planter. "A crude invention, which is called the 'Jumbo' wind engine, appeared in western Kansas about ten years ago, and is now coming into extensive use. It resembles the paddle wheel of a stern-wheel boat, with a shaft twelve or fourteen feet long, with a diameter of twelve or sixteen feet, with six or eight radial arms. The lower half of this horizontal wheel is shielded from the wind, so that the air acts only upon the upper vanes. A crank upon one end of the shaft connects with a pump. Its power can be indefinitely increased by increasing its length. It is said that a Jumbo giving one hundred horse power in a fifteen-mile wind can be put up at a cost of five hundred dollars. The wind acts on this sort of paddle wheel from all points of the compass except two."

THE recorded heights of what are called maximum waves on the ocean vary from forty feet from crest to hollow to ninety feet. The great storm waves travel very far and faster than the storms, so that preceding them they give warning of them. Sometimes they appear as a record of a far-away storm that is spent. When they have traveled beyond the limits of the wind that raised them they become long undulations, hardly noticed in deep water, but very evident in shallow places. These probably form the "rollers" that appear periodically in places situated in latitudes where gales do not occur. Other rollers are believed by Captain W. J. L. Wharton to be due to earthquakes or volcanic eruptions occurring in the bed of the sea. Of these are the sudden great waves which often cause so much destruction on the South American coasts.

A MARKED decrease in the killed and injured among railroad employees in 1894 is attributed in the report of the Interstate Commerce Commission to the smaller number of men, the smaller volume of business transacted, and perhaps to the increased use of automatic appliances and the improved grade of efficiency of the men. One man was killed out of every 428 in service, and one injured out of every 23. One passenger was killed out of each 1,912,618 carried, or for each 44,103,228 miles traveled; and one injured out of each 204,248 carried, or for each 4,709,771 miles traveled. A distribution of accidents to the terminal groups into which the railroads are divided exhibits the diversity in the relative safety of railway employment and of railway travel in the different sections of the country.

THE Reichsbank, the German Government's banking establishment recently made some instructive experiments, with cement as a fireproof covering for safes. A safe consisting of steel wire netting, between two layers of cement, was subjected to a heat of 1,800° F. for over half an hour. When the safe was opened, silk paper was found uninjured, and a maximum thermometer, which had been in the safe, had only registered 85° F.

SOME interesting observations on the relation of dust to rainfall and scenic effect were made during a trip to Greenland last summer by Prof. William H. Brewer, of the Sheffield Scientific School. He says that the fogs progressively thinned as they went farther north; that, owing to the small amount of dust in the air, the rain, even when streams were flowing from the scuppers,

was extremely fine, and seemed more like a fog, so that it was difficult to believe one's eyes, and that even a few moments in a thin fog sufficed to thoroughly wet one's outer garments. He also speaks of the absence of that bluish haze which so softens and beautifies a distant view in lower latitudes. Unfortunately, Dr. Brewer was not equipped for accurate meteorological research, or we should doubtless have had from him valuable data on this very important and interesting subject.

A CURIOUS attempt to combine color impressions with musical sounds was recently made in London, by Mr. Wallace Rimington. The instrument used, called a "color organ," was so arranged that each organ note had a corresponding colored disk; pressure on the key threw this disk in front of a powerful arc or lime light by which an image was projected on a screen, and at the same time a musical tone was produced by the organ. Extracts from Chopin and Wagner were rendered; the effects are said to have been in the main pleasing, and were certainly novel.

THE Royal Academy of Sciences of the Institute of Bologna offers a gold medal of one thousand francs' value for a memoir on a practical system for the prevention or extinction of fire. Italian, French, or Latin may be used; if in another language, it must be accompanied by an Italian translation. The essays should be signed by a *nom de plume* and accompanied by an envelope containing the author's real name. All essays must be in before May 29, 1896, and should be addressed to "*Al segretario della R. Accademia delle Scienze dell' Instituto di Bologna.*"

AN examination of teas grown at various altitudes was recently conducted in the Lancet Laboratory, and seems to show that while the content of caffeine, the refreshing and important constituent of the tea leaf, is not materially affected by an increase of altitude, the tannin, the astringent principle, which gives to the stronger teas their harsh, disagreeable flavor, is quite markedly decreased. The essential oils, on which the agreeable flavor and odor depend, are increased by growth in higher altitudes. Unfortunately, the higher the altitude the less the yield—as, for instance, at seven thousand feet above sea level at Darjeeling, the yield is only two hundred to three hundred pounds per acre, while on the plains of Assam, at an elevation of from only one hundred to five hundred feet, the yield averages one thousand pounds per acre.

THE report of the British Opium Commission is supplemented in a special memorandum by Sir William Roberts, who gives opium a position as to its effects on the system intermediate between alcohol and tobacco. But the habitual and excessive use of alcohol is followed by special organic changes that can be traced both during life and after death, while this is not the case with either opium or tobacco. Sir William thinks that the number of opium-eaters in India is likely to be underestimated rather than overestimated. He dwells upon the greater tolerance for opium among the natives of India as compared with Europeans, and cites the evidence of Surgeon-Lieutenant-Colonel Crombie as to the very different effect of opium on native and English infants in support of the view that this enhanced tolerance on the part of the natives of India is apparently congenital.

A UNIQUE specimen of the great auk's egg was sold recently in London. It is a perfect egg, which was obtained sixty or seventy years ago in Iceland. It sold for $866.25.

IN a paper read before the Geographical Club of Philadelphia, Mr. T. W. Balch relates several incidents observed by him in a journey through Alsace and Lorraine illustrative of the people's concealing French hearts under their Germanized exteriors. Among them was the evasion of the law forbidding the display of French flags, perceived in a show window in Strasburg. The storekeeper, with a thoroughly German name on his sign, had put in a conspicuous place some white candles between two packages of red ones, wrapped at the bottom in blue paper. "It was indeed a dull man who did not see at once the tricolor."

OBITUARY NOTES.

PROF. FRANZ NEUMANN, of the chair of Physics and Mineralogy at the University of Königsberg, died on May 23d at Königsberg, at the advanced age of ninety-seven. The work which placed him in the front ranks of science was a Mémoire sur la Théorie des Ondulations, presented to the Berlin Academy in 1835.

PROF. VALENTINE BALL, of Dublin, died on June 17th, aged fifty-two years. He was Director of the Museum of Science and Art of Dublin. He occupied the chair of Geology and Mineralogy in the University of Dublin from 1881 to 1883, and was the author of several works on geology.

THEODORE BRORSEN, best known from his discovery of five comets, has recently died, in the seventy-seventh year of his age. He discovered the comet that bears his name in 1846, and found its period to be five years and a half. It has since been seen at four returns, but not since 1879. He discovered a second comet in 1846, a third in 1847, and two others in 1851.